वाप्कोस लिमिटेड
WAPCOS LIMITED
(भारत सरकार का उपक्रम-जल शक्ति मंत्रालय)
(A Government of India Undertaking-Ministry of Jal Shakti)

Room No-C-24, Plot No-76 C, Institutional Area
Sector – 18, Gurugram-122015, Haryana

TENDER DOCUMENT FOR

CONSTRUCTION OF INDOOR SPORTS STADIUM AT CHAMBA, HIMACHAL PRADESH

WAP/CED/CHAMBA/2024/01
Date: 30/07/2024

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NOTICE INVITING TENDER (NIT)

NOTICE INVITING TENDER (NIT)

NIT No. WAP/CED/Chamba/2024/01 **Dated: 30/07/2024**

WAPCOS Limited (A Govt. of India Undertaking) invites "**Online Electronic Tenders"** on **EPC (Engineering Procurement and Construction) Basis"** from experienced and competent bidders, meeting prescribed qualifying criteria as mentioned in tender document.

1.	Name of Work / Project	:	CONSTRUCTION OF INDOOR STADIUM AT CHAMBA, HIMACHAL PRADESH
2.	Site / Location	:	Police Ground, Chamba, Himachal Pradesh
3.	Website for viewing tender	:	www.wapcos.co.in and https://etenders.gov.in/eprocure/app
4.	Website for Registration/ uploading of Tender and also viewing of Corrigendum/ Addendum, if any.		www.etenders.gov.in/eprocure
5.	Estimated Cost of Work	:	Rs. 8.5532 Crore Inclusive of all taxes excluding GST
6.	Joint Venture		Joint Ventures / Consortia of firms shall not be allowed
7.	Cost of Tender Document	:	Rs. 20,000/- (in form of Demand Draft/Online Transfer in favour of WAPCOS LIMITED payable at Gurugram)
8.	Amount of Earnest Money Deposit	:	Rs. 17,10,645/- (in form of Demand Draft/Bank Guarantee/FDR in favour of WAPCOS LIMITED payable at Gurugram)
9.	Solvency Certificate	:	40% of Estimated Cost of Work above (in original) from a Nationalised/Scheduled Commercial Bank approved by Reserve Bank of India (RBI). The Certificate shall have been issued after the publishing of NIT and as per given format only. The certificate should carry name, designation of the bank official, who has the authority to issue Solvency Certificate. **Note: This Certificates will be verified from the issuing authority by WAPCOS**.
10.	Project Completion Period	:	12 Months from the Date of Award which must be strictly adhered by the contractor
11.	Validity of Bid/Tender		180 Days from the date of opening of tender.
12.	Site Visit		Intending bidder have to visit site to inspect and examine the site at his own cost and its surrounding and satisfy themselves before submitting their bids as to nature of the ground and sub-soil (so far is practicable), the form and nature of the site Bidder representative shall investigate during site visit as location, depth of foundation, plinth level as per nearby road level, existing temple which require

			renovation etc.
13.	**Defect Liability Period**		*One (1) years from the date of successful completion of each component of the project and handing over to WAPCOS/Youth Service and Sports (YSS), Himachal Pradesh with all satisfaction & acceptance along with submission of all the required documents i.e. As- built drawings, Inventory list, guarantee / warranty bonds, certificates & invoices of equipment, lock and key of each room and NoCs form various Departments*
14.	Pre Bid Meeting		Not applicable. But the queries can be asked through email and telephone before the last date of bid submission. Details as follows: Email: environment@wapcos.co.in Telephone No- 0124-2397396
15.	Offline Submission of Technical document, Tender Fees, EMD etc. as detail in Tender for bidders**.**		20/08/2024 up to 15:00 hours in the office of Chief Executive Director (Environment, Construction Management & Administration)
16.	Last date & time for online submission of Technical & Financial Bid	:	20/08/2024 up to 15:00 hours
17.	Online opening of Technical Bid	:	21/08/2024 at 15:30 hours
18.	Online opening of Financial Bid	:	Intimated to Technical Qualified Bidders.
19.	Tender Inviting Authority and WAPCOS Communication address during Tendering and execution of works	:	Chief Executive Director (Envt & CM), WAPCOS Limited, Plot No- 76-C, Sector -18, Gurgaon- 122 015 Telephone: 0124-2397396 E-mail: environment@wapcos.co.in
20.	The Bid Security/ EMD / Solvency Certificate / BG against Performance Security shall be addressed to WAPCOS Corporate Office		WAPCOS Limited 76-C, Institution Area Sector-18, Gurugram, Haryana-122015
	If the office of WAPCOS Limited, New Delhi happens to be closed on the last date and time mentioned for any of the event, the said event will take place on the next working day at the same time and venue.		

The tender document has to be downloaded from above specified websites. Bidders are advised to visit above specified websites regularly for updates /Amendments/ Corrigendum, if any. The Updates/Corrigendum/Addendum shall be followed up to submission of tender and it will be the part of tender. The full details about the work, specifications, Drawings, terms and conditions shall be available in the Tender Document. The tender document has to be submitted online on websites https://etenders.gov.in/eprocure/app

The purpose of this NIT is to provide interested parties with information to assist the preparation of their bid. While WAPCOS Limited has taken due care in the preparation of the information contained herein, and believe it to be complete and accurate, neither it nor any of its authorities or agencies nor any of its respective officers, employees, agents or advisors give any warranty or make any representations, expressed or implied as to the completeness or accuracy of the information contained in this document or any information which may be provided in association with it.

Further, WAPCOS Limited does not claim that the information is exhaustive. Respondents to this NIT are required to make their own inquiries/ surveys and will be required to confirm, in writing, that they have done so and they did not rely solely on the information in NIT. WAPCOS Limited is not responsible if no due diligence is performed by the bidders.

IMPORTANT POINTS

1.1 The bidder should be an Indian Registered Company under Companies Act 1956/ 2013, Proprietorship Firm/ Partnership Firm.

1.2 Principal Employer/ Owner/Client means of Youth Service and Sports Department, Himachal

Pradesh herein referred as “YSS”.

1.3 Employer” shall mean “WAPCOS Limited”, A Government of India undertaking- Ministry of Jal Shakti, for execution of the Work / Project and WAPCOS is working as Central Agency under “Assistance to Central Agencies for Tourism Development Scheme under Department of Youth Service and Sports, Himachal Pradesh”.

1.4 All Bidders are hereby cautioned that Bids containing any deviation or reservation as described in Clauses of “Instructions to Bidders” shall be considered as non-responsive and shall be summarily rejected.

1.5 WAPCOS Ltd. reserves the right to accept or reject any or all bids without assigning any reasons. No Bidder shall have any cause of action or claim against the WAPCOS Ltd. For rejection of his Bid and will not be bound to accept the lowest or any other tender.

1.6 No reimbursement of cost of any type or on any account will be paid to persons or entities submitting their Bid.

1.7 All information submitted in response to this NIT shall be the property of WAPCOS Limited and it shall be free to use the concept of the same at its will.

1.8 It is hereby declared that WAPCOS is committed to follow the principle of transparency, equity and competitiveness in public procurement. The subject Notice Inviting Tender (NIT) is an invitation to offer made on the condition that the Bidder will sign the integrity Agreement, which is an integral part of tender/bid documents, failing which the tenderer/bidder will stand disqualified from the tendering process and the bid of the bidder would be summarily rejected. This declaration shall form part and parcel of the Integrity Agreement and signing of the same shall be deemed as acceptance and signing of the Integrity Agreement on behalf of the WAPCOS.

1.9 At the first instance the Technical Bids will be evaluated by the Tender Evaluation Committee (TEC) constituted for the purpose by WAPCOS. At the second stage, the financial bids of only those bidders, who qualify in the Technical Bid will be opened by the Committee members. The bid opening committee after evaluation of the Financial bids, will give its specific recommendations regarding the lowest responsive bid, which is to be selected along with a comparative statement duly signed by the members of the bid opening committee.

For and on behalf of WAPCOS LIMITED
Chief Executive Director (Envt & CM)
WAPCOS Limited

SECTION– I

INSTRUCTIONS TO BIDDER

SECTION– I

INSTRUCTIONS TO BIDDER

1.0 SPECIAL INSTRUCTIONS TO BIDDERS FOR E-TENDERING

1.1 GENERAL

Submission of Online Bids is mandatory for this Tender. E-Tendering is a new methodology for conducting Public Procurement in a transparent and secured manner. For conducting electronic tendering, bidders shall use the portal www.etenders.gov.in/eprocure . Tender is invited in Single Stage -Two Envelope system, one Technical Bid and second as financial bid. Accordingly, bidder is directed to make all formalities and registration on www.etenders.gov.in/eprocure website and submit the Technical Bid and Financial bid.

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: https://etenders.gov.in/eprocure/app.

1.2 REGISTRATION

1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: https://etenders.gov.in/eprocure/app) by clicking on the link "Online bidder Enrollment" on the CPP Portal which is free of charge.

2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.

3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.

4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.

5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.

6) Bidder then logs in to the site through the secured log-in by entering their user ID /password and the password of the DSC / e-Token.

1.3 SEARCHING FOR TENDER DOCUMENTS

1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.

3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

1.4 PREPARATION OF BIDS

1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.

2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or ''Other Important Documents'' area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

Note: My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.

1.5 SUBMISSION OF BIDS

1) ***Please uninstall any Java version if installed already. Then go to this link https://eprocure.gov.in/cppp/jre-windows-i586.exe and download this prescribed version of java for this portal***.

2) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

3) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

4) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

5) Bidder has to select the payment option as "offline" to pay the tender fee/EMD/Bid Security Declaration as applicable and enter details of the instrument.

6) Bidder should prepare the EMD/Bid Security Declaration as per the instructions specified in the tender document. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the tender documents. The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.

7) Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

8) The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.

9) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener's public keys. Overall, the

Uploaded tender documents become readable only after the tender opening by the authorized bid openers.

10) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.

11) Upon the successful and timely submission of bids (i.e. after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.

12) The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.

1.6 ASSISTANCE TO BIDDERS

1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk.
For any technical related queries please call at 24 x 7 Help Desk Number
0120-4001 002, 0120-4001 005, and 0120-6277 787

International Bidders are requested to prefix +91 as country code
E-Mail Support: For any Issues or Clarifications relating to the published tenders, bidders are requested to contact the respective Tender Inviting Authority
Technical - support-eproc@nic.in
Policy Related - cppp-doe@nic.in

For any assistance regarding the Tender Document and/or term and conditions the bidders may contact Dr. Aman Sharma, Chief Executive Director (Envt. CM.) or Mr. Deepender Lamba (Sr. Engineer), WAPCOS Limited, Environment Division, Plot No-76-C, Sector-18, Gurugram: Phone Number: 0124-2397396,; Email: environment@wapcos.co.in during office hours.

2.0 INSTRUCTIONS TO BIDDER

The purpose of these instructions to serve as a guide to Bidders for preparing offer for carrying out the project in all respect.

a) Submission of a tender by a tenderer implies that the tenderer has read this notice and all other Tender Documents and has made himself aware of the scope, the specifications, and conditions of contract, local conditions and other factors having bearings on the execution of the work.

b) WAPCOS Limited desires that the bidders, suppliers, and Sub-contractors under the Project, observe the highest standard of ethics during the performance, procurement and execution of such contracts. In pursuance of this requirement, WAPCOS Limited, defines, for the purposes of this provision, the terms set forth below:

   i. "Corrupt Practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;

ii. “Fraudulent Practice” means any act of submission of forged documentation, or omission, including a misrepresentation, that knowingly or recklessly misleads, or

Attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation, or to succeed in a competitive bidding process;

iii. "Coercive Practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

iv. "Collusive Practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.

Will reject the award of Contract, even at a later stage, if it determines that the bidder recommended/ selected for award/awarded has, directly or through an agent, engaged in Corrupt, Fraudulent, Collusive, Or Coercive Practices in competing for the Contract;

Will sanction a party or its successors, including declaring ineligible, either indefinitely or for a stated period of time, to participate in any further bidding/procurement proceedings under the Project, if it at any time determines that the party has, directly or through an agent, engaged in Corrupt, Fraudulent, Collusive, Or Coercive Practices in competing for, or in executing, the contract; and

The party may be required to sign an Integrity Pact, if required; and WAPCOS Limited will have the right to require the bidders, or its suppliers, contractors and consultants to permit WAPCOS Limited to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by WAPCOS Limited at the cost of the bidders.

The Bidder must obtain for himself on his own responsibility and at his own expenses all the information which may be necessary for the purpose of making a bid and for entering into a contract, must examine the Drawings, must inspect the sites of the work, acquaint himself with all local conditions, means of access to the work, nature of the work and all matters pertaining thereto. WAPCOS Limited will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

c) The Contract shall be governed by each SECTION OF TENDER DOCUMENT i.e. instructions to bidders, selection & qualifying criteria, scope of works, General Conditions for Contract (GCC), Special Conditions for Contract (SCC), Annexures, Forms, Drawings, Technical Specification, Addendum / Clarification / Corrigendum etc. and all other Conditions mentioned in the tender documents.

d) All Bidders are hereby explicitly informed that conditional offers or offers with deviations from the Conditions of Contract, the bids not meeting the minimum eligibility criteria, Technical Bids not accompanied with EMD/Bid Security Declaration and Tender Document Fees of requisite amount in acceptable format, Bids in altered/modified formats, or in deviation with any other requirements stipulated in the tender documents are liable to be rejected.

e) The company reserves the right to waive minor deviations if they do not materially affect the capability of the Tenderer to perform the contract

f) The bidders shall not tamper or modify any part of the tender documents in any manner. In case in part of the bid is found to be tampered or modified at any stage, the bids are liable to be rejected, the contract is liable to be terminated and the full earnest deposit/retention money/performance guarantee will be forfeited and the bidder will be

Liable to be banned from doing any business with WAPCOS Limited.

g) Incomplete Price bid shall be liable to be rejected, at the discretion of WAPCOS Limited. The total bid price shall cover the entire scope of works covered in the tender.

3.0 TENDER FEES AND EARNEST MONEY DEPOSIT (EMD)

The Tender Fee and EMD shall be submitted as per the details mentioned in the NIT. **The bids without Tender Processing Fee and/or Earnest Money Deposit shall be summarily rejected and shall not be evaluated further. In case tenderer revokes, cancels, or varies his tender in any manner without the consent of WAPCOS Limited, within this period, EMD shall be forfeited & Bidder will be debarred from participating in the future bidding process for two years.**

The EMD of unsuccessful tenderer(s) will be refunded after finalization of tender process. The Earnest Money deposit submitted by the successful tenderer shall be retained by WAPCOS Limited until the Performance Bank Guarantee (PBG) is submitted.

If any tenderer withdraws or make any changes in his offer already submitted before the expiry of the above validity period or any extension thereof without the written consent of the company, the EMD amount will be forfeited for such act of the tenderer. WAPCOS Limited reserves the right of forfeiture of Earnest Money deposit (EMD) in case of the successful tenderer.

- After opening of Tender, revokes his tender within the validity period or increases his earlier quoted rates.
- Does not commence the work within the period as per LOI/Contract. In case the LOI/Contract is silent in this regard then within 15 days after award of contract.
- EMD shall not carry any interest.

4.0 COST OF BIDDING

The Bidder shall bear all costs associated with the preparation and submission of the Bid as well as costs associated for facilitating the evaluation. WAPCOS Limited shall in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

5.0 LANGUAGE OF BID

The Bid and all related correspondence and documents relating to the Project shall be in English language only. Supporting documents and printed literature furnished by the Bidder may be in another language provided they are accompanied by an accurate English translation which shall be certified by a qualified translator. Any material that is submitted in a language other than English and which is not accompanied by an accurate English translation will not be considered.

6.0 CURRENCY OF BID

Bid prices shall be quoted in Indian Rupees. Tender submitted by tenderer shall remain valid for acceptance as mentioned in NIT from the date set for submission of the tender. The tenderer shall not be entitled within the said period to revoke or cancel or vary the tender

given or any item thereof, without the consent of WAPCOS Limited.

WAPCOS Limited reserves the right to reject any or all the bids or to cancel the Tender, without assigning any reason(s) whatsoever.

7. **PERIOD OF COMPLETION**

The completion period shall be as per NIT. The completion period is for the entire work of planning, execution, approvals, arrangement of materials, equipment, delivery at site including transportation, construction/ installation, testing, commissioning, NoCs & statutory approvals from local bodies and successfully handing over of the entire project to the satisfaction of the Principal Employer/ Employer.

8. **AMENDMENT OF BID DOCUMENTS**

At any time prior to the deadline for submission of bids, the Employer may, for any reason (s), whether at their own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by the issuance of a corrigendum/addendum. No modification of Bid shall be permissible after last date of submission, whatever may be the reason. The Employer may at their discretion may extend the deadline for submission of Tender/ Bid, if considered necessary.

Any corrigendum/ addendum thus issued shall be part of the bidding documents. Prospective Bidders shall download the same from the e-portal and submit along with
the submission of Bid as token of acceptance

For & on behalf of Tenderer

Chief Executive Director (Envt. & CM)
WAPCOS Limited

SECTION– II

SELECTION AND QUALIFYING CRITERIA

SECTION-II

SELECTION AND QUALIFYING CRITERIA

1.0 SITE VISIT

Intending Bidder(s) are advised to inspect and examine the site at his own cost and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. The means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid as it is **"Engineering Procurement & Construction (EPC) Contract" and Fixed Cost Tender**. A bidder(s) shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The bidder(s) shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a bid by a bidder(s) implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates at which stores, tools and plant, etc. will be issued to him by the Government and local conditions and other factors having a bearing on the execution of the work.

Site visit is to understand the actual scope of work/ site condition. The submission of tender will be treated like that bidder has done the site visit. Accordingly it is directed to bidders to visit the site at his own and investigate the site as required before submit the bid at his own cost. Submission of bid by a bidder(s) implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates and other factors having a bearing on the execution of the work.

2.0 PRE-BID MEETING

Not applicable. Queries can be asked via email and telephone number mentioned above.

3.0 QUALIFYING CRITERIA: ONLINE TECHNICAL BID SUBMISSION

The intending bidders must read the terms & conditions of tender documents carefully. He should only submit bid if he considers himself eligible and he is in possession of all the documents required.

The Technical Bid shall be uploaded **with coloured scanned copies of following documents. All the documents must be Serial wise as stated below along with check list and clearly marked page no. on each page *(MANDATORY*). Any Bid not in order with page no shall be rejected.**

Format of Check List				
S.N	**Particular of Document**	**Yes**	**No**	**Page Nos. (from – to)**
a)	Authorization Letter to sign the Tender on bidder's original letter head or Power of attorney *Note: Power of Attorney duly notarized and on a stamp paper of appropriate value, issued and signed by the*			

	member, authorizing the person for signing the tender documents, make corrections/ modifications, to interact with the Employer and act as the contact person, shall be submitted along with Technical Bid. The Power of Attorney shall be submitted in original and shall be specific to the Bid submission only.			
b)	Scanned copy of EMD as mentioned in NIT			
	Scanned copy of Demand Draft for Tender Fees of the amount as mentioned in NIT			
c)	Letter of Transmittal For Technical Bid along with Declaration by the Bidder on bidder's original letter Head as per given format			

Format of Check List				
S.N	**Particular of Document**	**Yes**	**No**	**Page Nos. (from – to)**
d)	Yearly sales Turnover and Audited Balance Sheet for Last 5 (Three) years ending on the financial year 2022-23			
	• The contractor should not have incurred any loss (profit after tax should be positive) in more than two years during last five years ending 2022-23 duly audited and ***Attested by the Independent Chartered Accountant***. **(Form-A)**			
	• **Turnover:** Average annual financial turnover **on Construction works** should be at least 50% of the estimated cost of work during the immediate last 3 consecutive financial years ending 2022-23. This should be duly audited by the Chartered Accountant doing Statutory Audit and mentioned UDIN Number on that certificate.			
	• Full Balance Sheet and Profit & loss Statement for last 5 years of Bidder should be verified by Chartered Accountant and mentioned UDIN Number on that certificate • Net worth of the company/firm as on 31st March of previous Financial Year should be positive			
	Turnover, profit, net worth certificates must be certified by the statutory auditor of the firm/company. Any such certificate must carry the UDIN (Unique Document Identification Number)			
e)	• The contractor should also have satisfactorily completed the similar types of works as mentioned below during last seven years ending previous day of last date of submission of tender.			

	i) One similar completed work costing not less than 80% of the estimated cost of work. Or ii) Two similar completed works of order value each not less than 50% of the estimated cost of work. Or iii) Three similar completed works of order value not less than 40% of the estimated cost of work. Note: **"Similar work"** refers to a work involving Building works comprising of construction of nonresidential buildings &/or residential building/Complex of RCC framed structure, complex, with provision of Fire-Fighting, PHE, Electrical, HVAC works and site development works. The bidder's shall submit Completion Certificate(s) mentioning name, nature of work(s), value(s) of the job(s), date(s) of commencement, stipulated date(s) of completion and actual date(s) of completion and actual date(s) of			

Format of Check List				
S.N	**Particular of Document**	**Yes**	**No**	**Page Nos. (from – to)**
	completion along- with LOI/(s)/W.O(s) from respective Owner(s)/Clients(s). Experience certificate from the concerned officer not below the rank of Executive Engineer or Equivalent need to be furnished by the bidder. • The eligible similar works executed and submitted by the bidders may be inspected by a committee which may consist of client or any other authority as decided by NIT approving authority. •Experience certificate issued by the same management/ sister concern/ joint venture etc. are not acceptable.			
f)	The bidder should not be insolvent, in receivership, bankrupt or being wound up, not have had their business activities suspended. Accordingly, Bidder shall submit Solvency certificate with details of Financial Status i.e. Name of the Banker & Current Solvency from Banker for a sum of at least 40% of the estimated cost of work Certificate in Original. ***IMPORTANT NOTE*** **: The Solvency Certificate shall be issued by the Nationalized/ Scheduled Commercial bank & must have been issued after the date of publication of NIT & be addressed to the tendering authority quoting the name of the work (Form-A-1)**			
g)	Name, Address, details of the Organization, Name(s) of the Owner/Partners/Promoters and Directors of the firm / company. **(Form-B)**			
h)	Copy of PAN Number, GST registration, EPF & ESIC registration, labour registration or undertaking (copy of registration).			
i)	**Goods and Service Tax (GST):** Bidders are advised to get themselves registered for GST, which are mandatory, as per Govt. of India notification regarding GST. Accordingly, bidder shall submit relevant documents if already registered. If not registered till date of submission of bid, bidder will give undertaking on bidder letter head stating that they will get registered in GST as per Govt. norms before submission of bills.			

j)	The bidder should be an Indian Registered Company under Companies Act 1956/Proprietorship Firm/ Partnership Firm. **Joint Ventures are not accepted.** Copy of Certificate of Incorporation/ Registration/ Partnership Deed Registration or any other relevant document, as applicable, should be submitted along with a copy of address proof. **NOTE:** Proprietor firms shall submit registration details or shall submit the copy of relevant page of Pass book for the Current Account in the name of Proprietor Firm.			
k)	Bidder should not be blacklisted/ debarred by any Government/ semi Government Department/ PSU. Bidders shall give undertaking for not being involved in any form of corrupt and fraudulent practices. The Blacklisting policy of the company is available on the official website of WAPCOS Limited. The bidder have to mandatorily furnish an undertaking addressing the same to Engineer-in-charge in the form of certificate to abide the contents of Blacklisting Policy. The format of undertaking is provided. Any action in violation of the blacklisting policy or to the certificate furnished shall result in cancellation of tender at the stage before or after the award of work. **(Form-C).**			

Format of Check List				
S.N	**Particular of Document**	**Yes**	**No**	**Page Nos. (from – to)**
l)	Letter of understanding the project site on bidder letter Head **(Form-D).**			
m)	'No Deviation Certificate' in prescribed format in Bidder's Letter Head **(Form-E).**			
n)	Consent Letter to execute the Integrity Pact along with Rs. 100 stamp paper (Integrity agreement) **(Form-F).**			
o)	Bidder shall submit Information on litigation history, liquidated damages, disqualification etc. in bidder Letter Head **(Form-G)**.			
p)	Bidder has to submit detailed Bar chart showing the timelines to complete the project in stipulated time period			
q)	Each page of the all Volume of Tender document & Addendum/ Corrigendum shall be Digitally signed by the bidders submitting the Tender in token of his/their having acquainted himself/ themselves and accepted the entire tender documents including various conditions of contract. Any Bid with any of the Documents not so signed is liable to be rejected at the discretion of WAPCOS Limited. ***(Do Not Submit with the document of Offline Submission)***			
r)	Information of the key technical representative who is going to associate with the project as per given format and Undertaking for Manpower Deployment			
s)	Undertaking regarding the Validity of the bid should be 120 days and after the award of work, if he (firm) is not taking over the work than his firm can be blacklisted for 2 years in participating of WAPCOS future tender.			
t)	All other forms given in the Form Section of NIT			
	If the bidder fail to submit any of the above document than it is liable to be rejected at the discretion of WAPCOS Limited. **The agency/contractor shall comply to the requirements, stipulations in the codes, standards and regulation Central Electricity authority/ Himachal Pradesh Norms. (Measurements relating to Safety and Electric Supply) Regulations 2010 with all its amendments up to date.* • *If the bidder fail to submit any of the above document than it is liable to be rejected at the discretion of WAPCOS Limited.* • *All uploaded tender document should be readable. In case the uploaded tender documents are found not readable even after zoom, the bidder will stand ineligible.* • *If a tendered quotes nil rates against each item in item rate tender or does not quote any percentage above/below on the total amount of the tender or any section/sub-head in percentage rate tender, the tender shall be treated as invalid.*			

4.0 OFFLINE SUBMISSIONS OF DOCUMENTS

The Bidder shall submit following Document offline also.

1. **All the documents in ORIGINAL, mentioned in "Section-II: Selection and Qualifying Criteria" in Para 3: Qualifying Criteria for Technical Bid i.e. at Sr. No. (a) to (p) along with checklist & page numbering *(MANDATORY)*** in separate sealed envelope clearly labeled as "TECHNICAL BID" for the Work (Write Name of Work/Project as mentioned in NIT) along with Details of Bidders Address, Phone, E-mail on Envelope.

2. **Originals EMD and Tender submission fee in the form of Demand Draft** in separate sealed envelope clearly labeled as "EMD AND TENDER FEE" for the work (Write Name of Work/Project as mentioned in NIT) along with Details of Bidders Address, Phone, and E-mail on Envelope.

NOTE: All above two envelopes shall be submitted in one single envelope clearly labeled as "Documents for Offline Submission" for the Work (Write Name of Work/Project as mentioned in NIT) along with Details of Bidders Address, Phone, E-mail on Envelope.

IMPORTANT NOTE: - The offline submissions as mentioned above shall be submitted on WAPCOS address mentioned in NIT as per date & time mentioned in NIT otherwise bids will be rejected.

Chief Executive Director
(Environment, Construction Management and Administration)
76-C, Institutional Area,
Sector-18, Gurgaon,
Haryana-122015
Tel: 0124-2397396
Email id: environment@wapcos.co.in

Note:

1. ***Financial Bid should not be included in the Technical Bid. if found so, the bid shall be summarily rejected.***
2. ***The offline submissions as mentioned above shall be submitted on WAPCOS address mentioned in NIT as per date & time mentioned in NIT otherwise bids will be rejected. Also, SFMS system will be used for receiving confirmation of Inward bank Guarantee. Indian Overseas Bank NHB Gurgaon, Branch Code- 1935, IFSC Code- IOBA0001935, beneficiary- WAPCOS Limited***
3. ***The proposal shall be in indelible ink and shall be signed by the Bidder or duly authorized person(s).***
4. ***Proposals received by facsimile shall be treated as defective, invalid and rejected.***
5. ***Only detailed proposals complete in all respect and in the forms indicated shall be treated as valid.***
6. ***No Bidder is allowed to modify, substitute or withdraw the Proposal after its submission***

7. ***Proposal shall be submitted in two parts (Technical & Financial). Each page of all parts should be page numbered and in conformance to the eligibility qualifications should be clearly indicated using an index page. The proposals should not contain any irrelevant or superfluous documents***
8. ***The bidder who has qualified the minimum qualifying criteria as outlined in NIT, shall be liable for financial opening.***
9. ***The bidder with lowest financial bid among those who passed the technical evaluation shall be liable for award of work.***
10. ***Evaluation Committee may, at its discretion, call for additional information from the Bidder(s). Such information has to be supplied within the given time frame, otherwise the Evaluation Committee shall make its own reasonable assumptions at the total risk and cost of Bidders and the proposal is likely to be rejected. Seeking clarifications cannot be treated as acceptance of the Proposal.***
11. ***After the public opening of Bids, information relating to the examination, clarification, evaluation and comparison of Bids and recommendations concerning the Award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process.***

5.0 CONTENTS OF FINANCIAL BID

The Financial Bid should be uploaded separately along with Technical bid before last date & time of submission of Tender Document.

The quoted cost filled in Summary of Cost, by bidders, should include all associated costs with the project including any out of pocket / mobilization expenses/ Custom duty (if any) , Buildings and other construction workers welfare cess, TDS, taxes (except GST) if any applicable as per Govt. terms, shall be paid by the Contractor. The Goods and Services Tax (GST) shall be paid extra over quoted cost.

It is mandatory to bidders to deposit GST within time limit framed by Govt. of India, if applicable. The Goods and Services Tax (GST), shall be reimbursed to the Agency only after uploading of bills by Contractor on GST Portal "to avail Input benefit of GST".

The company shall be performing all its duties of deduction of TDS and other deduction on payment made to the contractor as per applicable legislation in force on the date of submission of bid or to be newly / amended introduced during the execution of the Contract.

The tenderer shall quote cost up to zero decimal and as well as in words. In case of any discrepancy cost quoted in words shall prevail.

The payment will be made in percentage as per the schedule of stage wise payment

The Bill of quantity of tender is attached in Microsoft Excel format, bidder shall fill the rates only in soft format. The bidder will upload same filled soft Microsoft Excel copy during uploading of financial bid.

6.0 OPENING OF FINANCIAL BID

The financial bids of the technically qualified bidders shall be opened at the notified date &

time mentioned in NIT. Final selection of the bidder will be made based on the least cost method.

7. **SIGNING OF THE CONTRACT**

The letter of Award will be issued to the successful bidder by WAPCOS which will be duly signed & stamped by the successful bidder as token of unequivocal acceptance and confirmation within 5 working days. Subsequently, successful bidder shall submit the Performance Security of required value within the specified time period. Thereafter, on a date and time mutually agreed upon, the successful Bidder or his authorized representative shall attend the office for signing of the Contract Agreement.

Failure on the part of the successful Bidder to comply with the above requirements will Constitute sufficient grounds for the annulment of the Award and forfeiture of the Bid Security.

For & on behalf of Tenderer

SECTION – III

GENERAL CONDITIONS OF CONTRACT

SECTION – III
GENERAL CONDITIONS TO CONTRACT

1.0 GENERAL RULES AND DIRECTIONS

General Rules & Directions	**1.**	The work proposed for execution by contract will be notified in a form of invitation to tender by publication in Newspapers and / or posted on website as the case may be. This form will state the work to be carried out, as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tender, and the amount of the security deposit and Performance guarantee to be deposited by the successful tenderer and the percentage, if any, to be deducted from bills. Copies of the specifications, designs and drawings and any other documents required in connection with the work signed for the purpose of identification by the officer inviting tender shall also be open for inspection by the contractor at the office of officer inviting tender during office hours.
	2.	In the event of the tender being submitted by a Partnership firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a Power of Attorney authorizing him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.
	3.	Receipts for payment made on account of work, when executed by a Partnership firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm
Applicable for Item Rate EPC Tender	4	**NOT APPLICABLE** The rate(s) must be quoted in decimal coinage. Amounts must be quoted in full rupees by ignoring fifty paisa and considering more than fifty paisa as rupee one. In case the lowest tendered amount (worked out on the basis of quoted rate of Individual items) of two or more contractors is same, then such lowest contractors may be asked to submit sealed revised online offer (through limited tender process) quoting rate/ cost of work of each item of the schedule of quantity for all sub sections/sub heads as the case may be, but the revised quoted rate of each item of schedule of quantity for all sub sections/sub heads should not be higher than their respective original rate quoted already at the time of submission of tender. The lowest tender

		Shall be decided on the basis of revised offer.
		If the revised tendered amount (worked out on the basis of quoted rate of individual items) of two or more contractors received in revised offer is again found to be equal, then the lowest tender, among such contractors, shall be decided by draw of lots and the lowest contractors those have quoted equal amount of their tenders. In case of any such lowest contractor in his revised offer quotes rate of any item more than their respective original rate quoted already at the time of submission of tender, then such revised offer shall be treated invalid. Such case of revised offer of the lowest contractor or case of refusal to submit revised offer by the lowest contractor shall be treated as withdrawal of his tender before acceptance and 50% of his earnest money shall be forfeited or action as per provisions of the Bid Security Declaration. In case all the lowest contractors those have same tendered amount (as a result of their quoted rate of individual items), refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% of EMD or action as per provisions of the Bid Security Declaration of each lowest contractors. Contractor, whose earnest money is forfeited because of non-submission of revised offer, or quoting higher revised rate(s) of any item(s) than their respective original rate quoted already at the time of submission of his bid shall not be allowed to participate in the retendering process of the work.
Applicable for Percentage Rate EPC Tender Only	**4A**	In case of Percentage Rate Tenders, contractor shall fill up the usual printed form, stating at what percentage below/above (in figures as well as in words) the total estimated cost given in Schedule of Quantities, he will be willing to execute the work. The tender submitted shall be treated as invalid if :- 1. The contractor does not quote percentage above/below on the total amount of tender or any section/sub head of the tender. 2. The percentage above/below is not quoted in figures & words both on the total amount of tender or any section/sub head of the tender. 3. The percentage quoted above/below is different in figures & words on the total amount of tender or any section/sub head of the tender. Tenders, which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort including conditional rebates, will be summarily rejected.

	4B	In case the lowest tendered amount (estimated cost + amount worked on the basis of percentage above/below) of two or more contractors is same, such lowest contractors will be asked to submit revised online offer (through limited tender process) in the form of letter mentioning percentage above/ below on estimated cost of tender including all sub sections/sub heads as the case may be, but the revised percentage quoted above/below on tendered cost or on each sub section/ sub head should not be higher than the percentage quoted at the time of submission of tender. The lowest tender shall be decided on the basis of revised offers. In case any of such contractor refuses to submit revised offer, then it shall be treated as withdrawal of his tender before acceptance and 50% of earnest money shall be forfeited or action as per provisions of the Bid Security Declaration shall be taken. If the revised tendered amount of two more contractors received in revised offer is again found to be equal, the lowest tender, among such contractors, shall be decided by draw of lots in the presence WAPCOS & the lowest contractors those have quoted equal amount of their tenders. In case all the lowest contractors those have quoted same tendered amount, refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% of EMD or action as per provisions of the Bid Security Declaration of each contractor, whose earnest money is forfeited because of non-submission of revised offer, shall not be allowed to participate in the re- tendering process of the work.
	5.	The designated committee will open tenders in the presence of any intending contractors who may be present at the time, and will enter the amounts of the several tenders in a comparative statement in a suitable form. In the event of a tender being accepted, a receipt for the earnest money/Bid Security Declaration shall thereupon be given to the contractor who shall thereupon for the purpose of identification sign copies of the specifications and other documents. In the event of a tender being rejected, the earnest money shall thereupon be returned to the contractor remitting the same, without any interest, if applicable.
	6.	WAPCOS shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.
	7.	The receipt of an accountant or clerk for any money paid by the contractor will not be considered as any acknowledgment or payment to the officer inviting tender and the contractor shall be responsible for seeing that he procures a receipt signed by the officer inviting tender or a duly authorized Cashier.
Applicable for Item Rate EPC Tender only	**8.**	In the case of Item Rate Tenders, only rates quoted shall be considered. Any tender containing percentage below/above the

		rates quoted is liable to be rejected. Rates quoted by the contractor in item rate tender in figures and words shall be accurately filled in so that there is no discrepancy in the rates written in figures and words. However, if a discrepancy is found, the rates which correspond with the amount worked out by the contractor shall unless otherwise proved be taken as correct. If the amount of an item is not worked out by the contractor or it does not correspond with the rates written either in figures or in words, then the rates quoted by the contractor in words shall be taken as correct. Where the rates quoted by the contractor in figures and in words tally, but the amount is not worked out correctly, the rates quoted by the contractor will unless otherwise proved be taken as correct and not the amount. In event no rate has been quoted for any item(s), leaving space both in figure(s), word(s), and amount blank, it will be presumed that the contractor has included the cost of this/these item(s) in other items and rate for such item(s) will be considered as zero and work will be required to be executed accordingly. However, if a tenderer quotes nil rates against each item in item rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer and earnest money deposited shall be forfeited or action as per provisions of the Bid Security Declaration of each contractor. In the case of any tender where unit rate of any item/items appear unrealistic, such tender will be considered as unbalanced and in case the tenderer is unable to provide satisfactory explanation, such a tender is liable to be disqualified and rejected.
Applicable for percentage Rate EPC Tender only	**9.**	In case of Percentage Rate Tenders only percentage quoted shall be considered. Any tender containing item rates is liable to be rejected. Percentage quoted by the contractor in percentage rate tender shall be accurately filled in figures and words, so that there is no discrepancy.
Applicable for percentage Rate EPC Tender only	**10.**	In Percentage Rate Tender, the tenderer shall quote percentage below/above (in figures as well as in words) at which he will be willing to execute the work. He shall also work out the total amount of his offer and the same should be written in figures as well as in words in such a way that no interpolation is possible. In case of figures, the word 'Rs.' should be written before the figure of rupees and word 'P' after the decimal figures, e.g. ' Rs. 2.15P and in case of words, the word 'Rupees' should precede and the word 'Paisa' Should be written at the end.
	11.	i. The Contractor, whose tender is accepted, will be required to furnish performance guarantee of 3% (Three Percent) of the tendered amount within the period specified in Special Conditions of Contract. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs. 10,000/-) or

		Deposit at call receipt of any scheduled bank/Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the prescribed form. ii. The contractor whose tender is accepted will also be required to furnish by way of Security Deposit for the fulfillment of his contract, an amount equal to 2.5% of the tendered value of the work. The Security deposit will be collected by deductions from the running bills as well as final bill of the contractor at the rates mentioned above. The Security amount will also be accepted in cash or in the shape of Government Securities. Fixed Deposit Receipt of a Scheduled Bank or State Bank of India will also be accepted for this purpose provided confirmatory advice is enclosed.
	12.	On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Engineer-in-Charge shall be communicated in writing to the Engineer-in-Charge.
	13.	GST or any other tax applicable in respect of inputs procured by the contractor for this contract shall be payable by the Contractor and WAPCOS will not entertain any claim whatsoever in respect of the same.
	14.	On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Engineer-in-Charge shall be communicated in writing to the Engineer-in-Charge.
	15.	The tenderers shall sign a declaration under the officials Secret Act 1923, for maintaining secrecy of the tender documents drawings or other records connected with the work given to them.
	16.	The tender for the work shall not be witnessed by a contractor or contractors who himself/themselves has/have tendered or who may and has/have tendered for the same work. Failure to observe this condition would render, tenders of the contractors tendering, as well as witnessing the tender, liable to summary rejection.
	17.	The tender for composite work includes, in addition to building work, all other works such as sanitary and water supply installations drainage installation, electrical work, horticulture work, roads and paths etc. The tenderer apart from being a registered contractor (B&R) of appropriate class, must associate himself with agencies of appropriate class which are eligible to tender for sanitary and water supply drainage, electrical and horticulture works in the composite tender.
	18.	The contractor shall submit list of works which are in hand (progress) in the following form :-
	19.	The contractor shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued thereunder from time to

		time. If he fails to do so, his failure will be a breach of the contract and WAPCOS may in his discretion, without prejudice to any other right or remedy available in law, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.				
	19.	**Name of Work**	**Name and particulars where work is being executed**	**Value of Work**	**Position of works in progress**	**Remarks**
		(1)	(2)	(3)	(4)	(5)

2.0 CONDITIONS OF CONTRACT

Definitions	1.	The Contract means the documents forming the tender and acceptance thereof and the formal agreement executed between the WAPCOS and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-In-Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.
	2.	In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them:- "Employer" shall mean "WAPCOS Limited", A Government of India undertaking- Ministry of Jal Shakti, for execution of the Work / Project as mentioned in NIT. i. having their Registered office at 5th floor, Kailash building, 26- Kasturba Gandhi Marg, New Delhi-110001, India & include their successors & permitted assigns as well as their authorized officer / representatives ii. The "WAPCOS Limited" shall mean WAPCOS Limited. iii. The expression **works or Project** shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional. iv. The **Site** shall mean the land/or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract. v. The **Bidder /Contractor** shall mean the individual, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm or company who are participating in Bidding process and will Execution

		the project after award of the works as Contractor. vi. The **Engineer-in-Charge** means the Engineer Officer appointed by WAPCOS or his duly authorized representative who shall direct, supervise and be in-charge of the work for the purpose of this Contract vii. **Accepting Authority** shall mean the authority mentioned in Special Conditions of Contract. viii. **Tenderer / Bidder** shall mean the firm/party who intends to participate in this Notice Inviting Tender ix. **Excepted Risk** are risks due to riots (other than those on account of contractor's employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of Government, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by Government of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to Government's faulty design of works. **Market Rate** shall be the rate as decided by the Engineer-in-Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Special Conditions of Contract to cover, all overheads and profits, Provided that no extra overheads and profits shall be payable on the part(s) of work assigned to other agency(s) by the contractor as per terms of contract. x. **Schedule(s)** referred to in these conditions shall mean the relevant schedule(s) annexed to the tender papers or the standard Schedule of Rates of the government mentioned in Special Conditions of Contract hereunder, with the amendments thereto issued upto the date of receipt of the tender. xi. **District Specifications** means the specifications followed by the State Government in the area where the work is to be executed. xii. The **Contractor/Successful Bidder** shall mean the firm or company whose bid has been accepted by WAPCOS. xiii. **Consultant** shall mean any consultant nominated by the WAPCOS xiv. **Tendered value** means the value of the entire work as stipulated in the letter of award. xv. **Date of commencement of work:** The date of commencement of work shall be the date of start as specified in Special Conditions of Contract or the first date of handing over of the site, whichever is later, in accordance with the phasing if any, as indicated in the tender document. **GST** shall mean Goods and Service Tax - Central, State and Inter State.

Scope and Performance	3.	Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.
	4.	Headings and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.
	5.	The contractor shall be furnished, free of cost one certified copy of the contract documents except standard specifications, and such other printed and published documents, together with all drawings as may be forming part of the tender papers. None of these documents shall be used for any purpose other than that of this contract.
Works to be carried out	6.	The work to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule of Quantities/ Building Components shall, unless otherwise stated, be held to include wastage on materials, carriage and cartage, carrying and return of empties, hoisting, setting, fitting and fixing in position and all other labours necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.
Sufficiency of Tender	7.	The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the cost quoted in the Schedule of Quantities/ Building Components, which rates and prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.
Discrepancies and Adjustment of Errors	8.	The several documents forming the Contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.
	8.1	In the case of discrepancy between the schedule of Quantities/Building Components, the Specifications and/ or the Drawings, the following order of preference shall be observed:- i. Description of Schedule of Quantities/ Building Components/Drawings. ii. Particular Specification and Special Condition, if any. iii. Standard Specifications iv. Drawings. v. Indian Standard Specifications of B.I.S.
	8.2	If there are varying or conflicting provisions made in any one document forming part of the contract, the Accepting Authority shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.
	8.3	Any error in description, quantity or rate in Schedule of Quantities or any omission therefrom shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.

Signing of Contract	9.	The successful tenderer/contractor, on acceptance of his tender by the Accepting Authority, shall, within 15 days from the stipulated date of start of the work, sign the contract consisting of:- i. The notice inviting tender, all the documents including drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto. ii. Special Conditions of Contract consisting of: a) Various standard clauses with corrections up to the date stipulated in Special Conditions of Contract along with annexures thereto. b) Safety Code. c) Model Rules for the protection of health, sanitary arrangements for workers employed WAPCOS or its contractors. d) Contractor's Labour Regulations. e) List of Acts and omissions for which fines can be imposed. f) No payment for the work done will be made unless contract is signed by the contractor. g) General Conditions of Contract

3.0 CLAUSES OF CONTRACT

CLAUSE 1: PERFORMANCE GUARANTEE

i. The contractor shall submit an irrevocable **Performance Guarantee of 3% (three percent) of the tendered amount** in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in Special Conditions of Contract from the date of issue of letter of acceptance. This period can be further extended by the Engineer-in-Charge up to a maximum period as specified in Special Conditions of Contract on written request of the contractor stating the reason for delays in procuring the Performance Guarantee, to the satisfaction of the Engineer-in-Charge. This guarantee shall be in the form of Cash (in case guarantee amount is less than Rs. 10,000/-) or Banker's Cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay Order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Fixed Deposit Receipts or Insurance Surety Bonds or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the form annexed hereto. In case a fixed deposit receipt of any Bank is furnished by the contractor to the WAPCOS as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the WAPCOS to make good the deficit.

ii. **The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that**. In case the time for completion of work gets enlarged, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest. However, in case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.

iii. The Engineer-in-Charge shall make a claim under the performance guarantee except for

amounts to which the WAPCOS is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

(a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.

(b) Failure by the contractor to pay WAPCOS any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer in-Charge.

iv. In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the WAPCOS.

v. On substantial Completion of any work which has been completed to such an extent that the intended purpose of the work is met and ready to use, then a provisional Completion certificate shall be recorded by the Engineer-in-Charge. The provisional certificate shall have appended with a list of outstanding balance item of work that need to be completed in accordance with the provisions of the contract.

This provisional completion certificate shall be recorded by the concerned Engineer in- charge with the approval of competent authority, if required. After recording of the provisional Completion Certificate for the work by the competent authority, the 80% of performance guarantee shall be returned to the contractor, without any interest.

However, in case of contracts involving Maintenance of building and services /any other work after construction of same building and services/ other work, then 50% of performance guarantee shall be returned to the contractor, without any interest after recording the provisional Completion certificate.

Vi. The Performance Guarantee shall be refunded to the Contractor soon after the completion of works and issuance of the completion certificate.

CLAUSE 1A: RECOVERY OF SECURITY DEPOSIT

The person/persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit WAPCOS at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 2.5% of the gross amount of each running and final bill till the sum deducted will amount to security deposit of 2.5% of the tendered value of the work. Such deductions will be made and held by WAPCOS by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in cash or in the form of Government Securities or fixed deposit receipts. In case a fixed deposit receipt of any Bank is furnished by the contractor to the WAPCOS as part of the security deposit and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the WAPCOS to make good the deficit.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising therefrom, or from any sums which may be due to or may become due to the contractor by WAPCOS on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days

make good in cash or fixed deposit receipt tendered by the State Bank of India or by Scheduled Banks endorsed in favour of WAPCOS LIMITED, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills and the final bill of the contractor at the rates mentioned above.

The security deposit as deducted above can be released against bank guarantee issued by a scheduled bank, on its accumulations to a minimum of Rs. 5 lac subject to the condition that amount of such bank guarantee, except last one, shall not be less than Rs. 5 lac. Provided further that the validity of bank guarantee including the one given against the earnest money shall be in conformity with provisions contained in **Clause 17** which shall be extended from time to time depending upon extension of contract granted under provisions of **Clause 2** and **Clause 5**.

The Security Deposit shall be released after successful completion of Defect Liability Period

CLAUSE 2: COMPENSATION FOR DELAY

If the contractor fails to maintain the required progress in terms of **Clause 5** or to complete the work and clear the site on or before the contract or justified extended date of completion as per **Clause 5** (excluding any extension under **Clause 5.5**) as well as any extension granted under **Clauses 12 and 15**, he shall, without prejudice to any other right or remedy available under the law to the Government on account of such breach, pay as compensation the amount calculated at the rates stipulated below as the authority specified in Special Conditions of Contract may decide on the amount of accepted Tendered Value of the work for every completed day/month (as determined) that the progress remains below that specified in **Clause 5** or that the work remains incomplete.

i. Compensation for delay of work	with maximum rate @ 1% (one percent) per Month of delay to be computed on per day basis based on quantum of damage suffered due to stated delay on the part of Contractor.

Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tendered Value of work or of the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.

In case no compensation has been decided by WAPCOS during the progress of work, this shall be no waiver of right to levy compensation by the said authority if the work remains incomplete on final justified extended date of completion. If the Engineer in Charge decides to give further extension of time allowing performance of work beyond the justified extended date, the contractor shall be liable to pay compensation for such extended period. If any variation in amount of contract takes place during such extended period beyond justified extended date and the contractor becomes entitled to additional time under **Clause 12**, the net period for such variation shall be accounted for while deciding the period for levy of compensation. However, during such further extended period beyond the justified extended period, if any delay occurs by events under sub **Clause 5.2**, the contractor shall be liable to pay compensation for such delay.

Provided that compensation during the progress of work before the justified extended date of completion for delay under this clause shall be for non-achievement of sectional completion or part handing over of work on stipulated/justified extended date for such part work or if delay affects any other works/services. This is without prejudice to right of action by the Engineer in Charge under **Clause 3** for delay in performance and claim of compensation under that clause.

In case action under **Clause 2** has not been finalized and the work has been determined under **Clause**

3, the right of action under this clause shall remain post determination of contract but levy of compensation shall be for days the progress is behind the schedule on date of determination, as assessed by the WAPCOS, after due consideration of justified extension. The compensation for delay, if not decided before the determination of contract, shall be decided after of determination of contract.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the WAPCOS. In case, the contractor does not achieve a particular milestone mentioned in Special Conditions of Contract, or the re-scheduled milestone(s) in terms of **Clause 5.4**, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

Note: In case Liquidity Damage imposed by Principal Employer to the project at any point of time, then full amount of Liquidity Damage (10% of the Contract Price) will be recovered from the up-coming interim bills/ final bill. If the amount of up-coming interim bills/ final bill is less than the amount of Liquidity Damage, then balance amount of Liquidity Damage will be recovered from the Performance Security, Security Deposit and any other financial deposit of Contractor with Employer.

CLAUSE 3: WHEN CONTRACT CAN BE DETERMINED

Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

i. If the contractor having been given by the Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or un-workman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.

ii. If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer-in-Charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continues to do so after a notice in writing of seven days from the Engineer-in-Charge.

iii. If the contractor fails to complete the work or section of work with individual date of completion on or before the stipulated or justified extended date, on or before such date of completion; and the Engineer in Charge without any prejudice to any other right or remedy under any other provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence of such mutual agreement by his own assessment making such time essence of contract and in the opinion of Engineer- in-Charge the contractor will be unable to complete the same or does not complete the same within the period specified.

iv. If the contractor persistently neglects to carry out his obligations under the contract and/ or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge.

v. If the contractor shall offer or give or agree to give to any person in WAPCOS service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for WAPCOS.

vi. If the contractor shall enter into a contract with WAPCOS in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in-Charge.

vii. If the contractor had secured the contract with WAPCOS as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.

viii. If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.

ix. If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

x. If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.

xi. If the contractor assigns (excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (engagement of labour on a piece- work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer -in-Charge. When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the WAPCOS shall have powers:

(a) To determine the contract as aforesaid so far as performance of work by the Contractor is concerned (of which determination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, Security Deposit already recovered, Security deposit payable and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the Government.

(b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work including any new items needed to complete the work. In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer- in-Charge has certified in writing the

performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

CLAUSE 3A: NOT APPLICABLE

In case, the work cannot be started due to reasons not within the control of the contractor within 1/8th of the stipulated time for completion of work or one month whichever is higher, either party may close the contract. In case contractor wants to close the contract, he shall give notice to the WAPCOS stating the failure on the part of WAPCOS. In such eventuality, the Performance Guarantee of the contractor shall be refunded within following time limits:

a)	Tendered value of work is up to Rs. 1.0 Crore	15 days
b)	If the Tendered value of work is more than Rs.1.0 crore and up to Rs. 10 Crore	21 days
c)	If the Tendered value of work exceeds Rs. 10 Crore :	30 days

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party

CLAUSE 4: CONTRACTOR LIABLE TO PAY COMPENSATION EVEN IF ACTION NOT TAKEN UNDER CLAUSE 3

In any case in which any of the powers conferred upon the Engineer-in-Charge by **Clause-3** thereof, shall have become exercisable and the same are not exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer-in-Charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Engineer-in-Charge which shall be final and binding on the contractor) use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-Charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work/or any part thereof, paying or allowing for the same in account at the contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Engineer-in-Charge, whose certificate thereof shall be final, and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) in the event of the contractor failing to comply with any such requisition, the Engineer-in-Charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Engineer-in-Charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

CLAUSE 5: TIME AND EXTENSION FOR DELAY

The time allowed for execution of the Works as specified in the Special Conditions of Contract or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the works shall commence from such time period as mentioned in Special Conditions of Contract or from the date of handing over of the site whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, WAPCOS shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the performance guarantee absolutely.

5.1 As soon as possible but within 7 (seven) working days of award of work and in consideration of:

(a) Schedule of handing over of site as specified in the Special Conditions of Contract

(b) Schedule of issue of designs as specified in the Special Conditions of Contract

(i) The Contractor shall submit a Time and Progress Chart for each mile stone. The Engineer-in-Charge may within 7 (seven) working days thereafter, if required modify, and communicate the program approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved by the Engineer-in-Charge. The work programme shall include all details of balance

drawings and decisions required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer in- Charge and the Contractor within the limitations of time imposed in the Contract documents.

(ii) In case of non-submission of construction programme by the contractor, the program approved by the Engineer-in-Charge shall be deemed to be final.

(iii) The approval by the Engineer-in-Charge of such programme shall not relieve the contractor of any of the obligations under the contract.

(iv) The contractor shall submit the Time and Progress Chart and progress report using the mutually agreed software or in other format decided by Engineer-in- Charge for the work done during previous month to the Engineer-in-charge on or before 5th day of each month failing which a recovery as per Schedule F to be decided by the NIT approving authority shall be made on per week or part basis in case of delay in submission of the monthly progress report.

5.2 If the work(s) be delayed by :-

(i) force majeure, or

(ii) abnormally bad weather, or

(iii) serious loss or damage by fire, or

(iv) civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or

(v) delay on the part of other contractors or tradesmen engaged by Engineer-in- Charge in executing work not forming part of the Contract, or

(vi) Any other cause like above which, in the reasoned opinion of the Engineer-in-Charge is beyond the Contractor's control.

then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the authority as indicated in Special Conditions of Contract but shall nevertheless use constantly his best endeavours to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

The contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in **sub clause 5.2**.

5.3 In case the work is hindered by the WAPCOS or for any reason / event, for which the WAPCOS is responsible, the authority as indicated in Special Condition of Contract shall, if justified, give a fair and reasonable extension of time and reschedule the mile stones for completion of work. Such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law; provided further that for concurrent delays under this sub clause and sub clause **5.2** to the extent the delay is covered under sub **clause 5.2** the contractor shall be entitled to only extension of time and no damages.

5.4 Request for rescheduling of Mile stones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within 14 (fourteen days) of the happening of the event causing delay on the prescribed forms i.e. Form of application by the contractor for seeking rescheduling of milestones or Form of application by the contractor for seeking extension of time respectively to the authority as indicated in Special Conditions of Contract. The Contractor shall indicate in such a request the period by which rescheduling of milestone/s or extension of time is desired. With every request for rescheduling of milestones, or if at any time the actual progress of work falls behind the approved programme by more than 10% of the stipulated period of completion of contract, the contractor shall produce a revised programme, which shall include all details of pending drawings and decisions required to complete the contract and also the target dates by which these details should be available without causing any delay in execution of the work. A recovery as specified in Special Conditions of Contract shall be made on per day basis in case of delay in submission of the revised programme.

5.4 In any such case the authority as indicated in Special Conditions of Contract may give a fair and reasonable extension of time and reschedule the mile stones for completion of work. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority as indicated in Special Conditions of Contract in writing, within 3 months or 4 weeks of the date of receipt of such request respectively. Non application by the contractor for extension of time/ rescheduling of the milestones shall not be a bar for giving a fair and reasonable extension/ rescheduling of the milestones by the authority as indicated in Special Conditions of Contract and this shall be binding on the contractor.

5.5 In case the work is delayed by any reasons, in the opinion of the Engineer-in-Charge, by the contractor for reasons beyond the events mentioned in **Clause 5.2** or **Clause 5.3** or **Clause 5.4** and beyond the justified extended date; without prejudice to right to take action under **Clause 3**, the Engineer-in-Charge may grant extension of time required for completion of work without rescheduling of milestones. The contractor shall be liable for levy of compensation for delay for such extension of time.

CLAUSE 6: MEASUREMENTS OF WORK DONE

Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurement, the value in accordance with the contract of work done.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Measurement Book having pages of A-4 size as per the format of the WAPCOS so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the contractor from the Engineer-in-Charge or his authorized representative as per interval or program fixed in consultation with Engineer-in-Charge or his authorized representative. After the necessary corrections made by the Engineer-in-Charge, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the Engineer-in-Charge for the dated signatures by the Engineer-in- Charge and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the

Engineer-in-Charge and/or his authorized representative. The contractor will, thereafter, incorporate such changes as may be done during these checks/test checks in his draft measurements, and submit to the WAPCOS a measurement book, duly bound, and with its pages machine numbered. The Engineer-in- Charge and/or his authorized representative would thereafter check this MB, and record the necessary certificates for their checks/test checks.

The final, fair, computerized measurement book given by the contractor, duly bound, with its pages machine numbered, should be 100% correct, and no cutting or over-writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh MB with its pages duly machine numbered and bound, after getting the earlier MB cancelled by the WAPCOS. This should be done before the corresponding bill is submitted to the WAPCOS Nodal Office for payment. The contractor shall submit two spare copies of such MB's for the purpose of reference and record by the various officers of the WAPCOS.

The contractor shall also submit to the WAPCOS separately his Abstract of Cost and the bill based on these measurements, duly bound, and its pages machine numbered along with two spare copies of the "bill. Thereafter, this bill will be processed by the Office-in-charge and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.

The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements/levels by the Engineer-in- Charge or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give, not less than 7 (seven) days' notice to the Engineer-in-Charge or his authorized representative in charge of the work, before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge or his authorized representative in charge of the work who shall within the aforesaid period of 7 (seven) days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Engineer-in-Charge's consent being obtained in writing, the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Engineer-in-Charge or his authorized representative may cause either themselves or through another officer of the WAPCOS to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that recording of measurements of any item of work in the measurement book and/or its payment in the interim, on account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it

relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 6A : COMPUTERIZED MEASUREMENT BOOK

Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurementthe value of work done in accordance with the contract.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Computerized Measurement Book having pages of A-4 size as per the format of the WAPCOS so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative fromtime to time, during the progress of the work, shall be got checked by the contractor from the Engineer-in-Charge or his authorized representative as per interval or program fixed in consultationwith Engineer-in-Charge or his authorized representative. After the necessary corrections made by the Engineer-in-Charge, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the Engineer-in- Charge for the dated signatures by the Engineer-in- Charge and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the Engineer-in-Charge and/or his authorized representative. The contractor will, thereafter, incorporate such changes as may be done during these checks/test checks in his draft computerized measurements, and submit to the WAPCOS a computerized measurement book, duly bound, and with its pages machine numbered. The Engineer-in-Charge and/or his authorized representative would thereafter check this MB, and record the necessary certificates for their checks/test checks.

The final, fair, computerized measurement book given by the contractor, duly bound, with its pages machine numbered, should be 100% correct, and no cutting or over-writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh computerized MB with its pages duly machine numbered and bound. The contractor shall submit two spare copies of such computerized MB's for the purpose of reference and records.

The contractor shall also submit to the WAPCOS separately his computerized Abstract of Cost and

the bill based on these measurements, duly bound, and its pages machine numbered along with two spare copies of the bill. Thereafter, this bill will be processed by the Engineer-In-Charge

The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements/levels by the Engineer-in- Charge or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give not less than seven days' notice to the Engineer-in-Charge or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work in order that the same may be checked and/or test checked and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of checking and/or test checking measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of checking and/or test checking measurements without such notice having beengiven or the Engineer-in-Charge's consent being obtained in writing the same shall be uncovered atthe Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Engineer-in-Charge or his authorized representative may cause either themselves or throughanother officer of the WAPCOS to check the measurements recorded by contractor and allprovisions stipulated herein above shall be applicable to such checking of measurements or levels. It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and/or its payment in the interim, on account of final bill shallnot be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 7: PAYMENT ON INTERMEDIATE CERTIFICATE TO BE REGARD AS ADVANCE --- NOT APPLICABLE

No payment shall be made for work, estimated to cost Rs. Twenty thousand or less till after the whole of the work shall have been completed and certificate of completion given. For works estimated to cost over Rs. Twenty thousand, the interim or running account bills shall be submitted by the contractor for the work executed on the basis of such recorded measurements on the format of the WAPCOS in triplicate on or before the date of every month fixed for the same by the Engineer- in-Charge. The contractor shall not be entitled to be paid any such interim payment if the gross work done together with net payment/ adjustment of advances for material collected, if any, since the last such payment is less than the amount specified in Special Conditions of Contract, in which case the interim bill shall be prepared on the appointed date of the month after the requisite progress is achieved. Engineer-in-Charge shall arrange to have the bill verified by taking or causing to be taken, where necessary, the requisite measurements of the work. In the event of the failure of the contractor to submit the bills, Engineer-in-Charge shall prepare or cause to be prepared such bills in which event no claims whatsoever due to delays on payment including that of interest shall be payable to the contractor. Payment on account of amount admissible shall be made by the Engineer-in- Charge certifying the sum to which the contractor is considered entitled by way of interim payment at such rates as decided by the Engineer-in-Charge. The amount admissible shall be paid by 10th working day after the day of presentation of the bill by the Contractor to the Engineer-in-Charge together with the

account of the material issued by the WAPCOS, or dismantled materials, if any. In the case of works outside the headquarters of the Engineer- in-Charge, the period of ten working days will be extended to fifteen working days.

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion, interim payments shall continue to be made as herein provided without prejudice to the right of the WAPCOS to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

The Engineer-in-Charge in his sole discretion on the basis of a certificate from the Engineer-In- Charge to the effect that the work has been completed up to the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) up to lintel level (including sunshade etc.) and slab level, for each floor working out at 75% of the assessed value. The advance payments so allowed shall be adjusted in the subsequent interim bill by taking detailed measurements thereof.

In case of composite tenders, running payment for the major component shall be made by Engineer-In-Charge of major discipline to the main contractor. Running payment for minor component shall be

made by the Engineer-in-Charge of the discipline of minor component directly to the main contractor.

In case main contractor fails to make the payment to the contractor associated by him within 15 days of receipt of each running account payment, then on the written complaint of contractor associated for such minor component, Engineer in charge of minor component shall serve the show cause to the main contractor and if reply of main contractor either not received or found unsatisfactory, he may make the payment directly to the contractor associated for minor component as per the terms and conditions of the agreement drawn between main contractor and associate contractor fixed by him. Such payment made to the associate contractor shall be recovered by Engineer-in-charge of major or minor component from the next R/A/ final bill due to main contractor as the case may be.

CLAUSE 7A:

No Running Account Bill shall be paid for the work till the applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable are submitted by the contractor to the Engineer-in-Charge.

CLAUSE 8: COMPLETION CERTIFICATE AND COMPLETION PLANS

Within ten days of the completion of the work, the contractor shall give notice of such completion to the Engineer-in-Charge and within thirty days of the receipt of such notice, the Engineer-in- Charge shall inspect the work and if there is no defect in the work, shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of the execution; thereof, and not until the work shall have been measured by the Engineer-in-Charge. If the contractor shall fail to comply with the requirements of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Engineer-in-Charge may at the expense of the contractor remove such scaffolding, surplus materials and rubbish etc. and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8A : CONTRACTOR TO KEEP SITE CLEAN

When the annual repairs and maintenance of works are carried out, the splashes and droppings from white washing, colour washing, painting etc., on walls, floor, windows, etc shall be removed and the surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done: without waiting for the actual completion of all the other items of work in the contract. In case the contractor fails to comply with the requirements of this clause, the Engineer-in-Charge shall have the right to get this work doneat the cost of the contractor either WAPCOS or through any other agency. Before taking such action, the Engineer-in-Charge shall give ten days' notice in writing to the contractor.

CLAUSE 8B: COMPLETION PLANS TO BE SUBMITTED BY THE CONTRACTOR

The contractor shall submit completion plans for Internal and External Civil, Electrical and Mechanical Services within thirty days of the completion of the work, provided that the service plans having been

issued for execution by the Engineer-in-Charge, unless the contractor, by virtue of any other provision in the contract, is required to prepare such plans.

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay a sum of 0.1 % (zero point one percent) of accepted Tendered Value or limit prescribed in Special Condition of Contract whichever is more as may be fixed by the authority as mentioned in Special Condition of Contract and in this respect the decision of the that authority shall be final and binding on the contractor.

CLAUSE 9: PAYMENT OF FINAL BILL

The final bill shall be submitted by the contractor in the same manner as specified in interim bills within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within the period specified herein under, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized Engineer, complete with account of materials issued by the WAPCOS and dismantled materials.

a)	Tendered value of work is up to Rs. 1.0 Crore	4 months
b)	If the Tendered value of work is more than Rs. 1.0 Crore and up to Rs. 10.0 Crore	8 months
c)	If the Tendered value of work exceeds Rs. 10.0 Crore :	12 months

CLAUSE 9A: PAYMENT OF CONTRACTOR'S BILLS TO BANKS

Payments due to the contractor may, if so desired by him, be made to his bank, registered financial, co-operative or thrift societies or recognized financial institutions instead of direct to him provided that the contractor furnishes to the Engineer-in-Charge (1) an authorization in the form of a legally valid document such as a power of attorney conferring authority on the bank; registered financial, co-operative or thrift societies or recognized financial institutions to receive payments and (2) his own acceptance of the correctness of the amount made out as being due to him by WAPCOS or his signature on the bill or other claim preferred against WAPCOS before settlement by the Engineer- in-Charge of the account or claim by payment to the bank, registered financial, co-operative or thrift societies or recognized financial institutions. While the receipt given by such banks; registered financial, co-operative or thrift societies or recognized financial institutions shall constitute a full and sufficient discharge for the payment, the contractor shall whenever possible present his bills duly receipted and discharged through his bank, registered financial, co-operative or thrift societies or recognized financial institutions.

Nothing herein contained shall operate to create in favour of the bank; registered financial, co-operative or thrift societies or recognized financial institutions any rights or equities vis-à-vis the WAPCOS.

CLAUSE 10 : MATERIALS SUPPLIED BY WAPCOS ----------NOT APPLICABLE

Materials which WAPCOS will supply are shown in Special Conditions of Contract (SCC) which also stipulates quantum, place of issue and rate(s) to be charged in respect thereof. The contractor shall be bound to procure them from the Engineer-in-Charge.

As soon as the work is awarded, the contractor shall finalize the programme for the completion of work as per clause 5 of this contract and shall give his estimates of materials required on the basis of drawings/or schedule of quantities of the work. The Contractor shall give in writing his requirement to the Engineer-in-Charge which shall be issued to him keeping in view the progress of work as assessed by the Engineer-in-Charge, in accordance with the agreed phased programme of work indicating monthly requirements of various materials. The contractor shall place his indent in writing for issue of such materials at least 7 days in advance of his requirement.

Such materials shall be supplied for the purpose of the contract only and the value of the materials so supplied at the rates specified in the aforesaid schedule shall be set off or deducted, as and when materials are consumed in items of work (including normal wastage) for which payment is being made to the contractor, from any sum then due or which may therefore become due to the contractor under the contract or otherwise or from the security deposit. At the time of submission of bills, the contractor shall certify that balance of materials supplied is available at site in original good condition.

The contractor shall submit along with every running bill (on account or interim bill) material wise reconciliation statements supported by complete calculations reconciling total issue, total consumption and certified balance (diameter/section-wise in the case of steel) and resulting variations and reasons therefore. Engineer-in-Charge shall (whose decision shall be final and binding on the contractor) be within his rights to follow the procedure of recovery in clause 42 at any stage of the work if reconciliation is not found to be satisfactory.

The contractor shall bear the cost of getting the material issued, loading, transporting to site, unloading, storing under cover as required, cutting assembling and joining the several parts together as necessary. Notwithstanding anything to the contrary contained in any other clause of the contract and (or the CPWA Code) all stores/materials so supplied to the contractor or procured with the assistance of the WAPCOS shall remain the absolute property of WAPCOS and the contractor shall be the trustee of the stores/materials, and the said stores/materials shall not be removed/disposed off from the site of the work on any account and shall be at all times open to inspection by the Engineer-in-Charge or his authorized agent. Any such stores/materials remaining unused shall be returned to the Engineer-in- Charge in as good a condition in which they were originally supplied at a place directed by him, at a place of issue or any other place specified by him as he shall require, but in case it is decided not to take back the stores/materials the contractor shall have no claim for compensation on any account of such stores/materials so supplied to him as aforesaid and not used by him or for any wastage in or damage to in such stores/materials.

On being required to return the stores/materials, the contractor shall hand over the stores/ materials on being paid or credited such price as the Engineer-in-Charge shall determine, having due regard to the condition of the stores/materials. The price allowed for credit to the contractor, however, shall be at the prevailing market rate not exceeding the amount charged to him, excluding the storage charge, if any. The decision of the Engineer-in-Charge shall be final and conclusive. In the event of breach of the aforesaid condition, the contractor shall in addition to throwing himself open to account for contravention of the terms of the licenses or permit and/or for criminal breach of trust, be liable to WAPCOS for all advantages or profits resulting or which in the usual course would have resulted to him by reason of such breach. Provided that the contractor shall in no case be entitled to any compensation or damages on account of any delay in supply or non-supply thereof all or any such materials and stores provided further that the contractor shall be bound to execute the entire work if the materials are supplied by the WAPCOS within the original scheduled time for completion of the work plus 50% thereof or schedule time plus 6 months whichever is more if the time of completion of work exceeds 12 months, but if a part of the materials only has been supplied within the aforesaid period, then the contractor shall be bound to do so much of the work as may be possible with the materials and stores supplied in the aforesaid period. For the completion of the rest of the work, the contractor shall be entitled to such extension of time as may be determined by the Engineer-in-Charge whose decision in this regard shall be final and binding on the contractor.

The contractor shall see that only the required quantities of materials are got issued. Any such material remaining unused and in perfectly good/original condition at the time of completion or determination of the contract shall be returned to the Engineer-in-Charge at the stores from which it was issued or at a place directed by him by a notice in writing. The contractor shall not be entitled for loading, transporting, unloading and stacking of such unused material except for the extra lead, if any involved, beyond the original place of issue.

CLAUSE 10A: MATERIALS TO BE PROVIDED BY CONTRACTOR

The contractor shall, at his own expense, provide all materials, required for the works other than those which are stipulated to be supplied by the WAPCOS

The contractor shall, at his own expense and without delay, supply to the Engineer-in- Charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Engineer-in-Charge furnish proof, to the satisfaction of the Engineer-in-Charge that the materials so comply. The Engineer-in- Charge shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer-in-Charge for his approval, fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer-in-Charge shall be issued after the test results are received.

The Contractor shall at his risk and cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Engineer-in- Charge. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Engineer-in-Charge may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer-in-Charge and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. The Engineer-in- Charge or his authorized representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

The Engineer-in-Charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

The contractor shall at his own expense, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped at least with the testing equipment as specified in Special Conditions of Contract.

Minimum 01 year warranty for Mechanical & Electrical Equipment and other bought out items, at the discretion of WAPCOS Limited, if supplied directly by the contractor. The standard warranty period offered by the Manufacturer shall be retained, in case the original warranty period is more than one year.

CLAUSE 10B:

(i) SECURED ADVANCE ON NON-PERISHABLE MATERIALS

The contractor, on signing an indenture in the form to be specified by the Engineer-in- Charge, shall be entitled to be paid during the progress of the execution of the work up to 75% of the assessed value of any materials which are in the opinion of the Engineer-in- Charge non-perishable, non-fragile and non-combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered/ deducted from the next payment made under any of the clause or clauses of this contract.

Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of the Engineer-in-Charge provided the contractor provides a comprehensive insurance cover for the full cost of such materials. The decision of the Engineer-in-Charge shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on high-risk materials such as ordinary glass, sand, petrol, diesel etc.

(ii) MOBILISATION ADVANCE

Mobilization advance not exceeding 10% of the tendered value may be given, if requested by the contractor in writing within one month of the order to commence the work. Such advance shall be in two or more installments to be determined by the Engineer-in- Charge at his sole discretion. The first installment of such advance shall be released by the Engineer- in-charge to the contractor on a request made by the contractor to the Engineer-in-Charge in this behalf. The second and subsequent installments shall be released by the Engineer-in- Charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier installment to the entire satisfaction of the Engineer-in-Charge.

Before any installment of advance is released, the contractor shall execute a Bank Guarantee Bond from Scheduled Bank for the amount equal to 110% of the amount of advance and valid for the contract period. This (Bank Guarantee from Scheduled Bank for the amount equal to 110% of the balance amount of advance) shall be kept renewed from time to time to cover the balance amount and likely period of complete recovery.

(iii) INTEREST & RECOVERY

The mobilization advance in (ii) above bear simple interest at the rate of 10 percent per annum and shall be calculated from the date of payment to the date of recovery, both days inclusive, on the outstanding amount of advance. Recovery of such sums advanced shall be made by the deduction from the contractors bills commencing after first ten percent of the gross value of the work is executed and paid, on pro-rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time 80% (eighty percent) of the gross value of the contract is executed and paid, together with interest due

on the entire outstanding amount up to the date of recovery of the installment.

If the circumstances are considered reasonable by the Engineer-in-Charge, the period mentioned in (ii) and (iii) for request by the contractor in writing for grant of mobilization advance may be extended at the discretion of the Engineer-in-Charge.

CLAUSE 10C: PAYMENT ON ACCOUNT OF INCREASE IN PRICE / WAGES DUE TO STATUTORY ORDER -------- NOT APPLICABLE

If after submission of the tender, the price of any material incorporated in the works (excluding the materials covered under Clause 10CA and not being a material supplied from the Engineer-in- Charge's stores in accordance with Clause 10 thereof) and/or wages of labour increases as a direct result of the coming into force of any fresh law, or statutory rule or order (but not due to any changes of rate in sales tax/VAT, Central/State Excise/Custom Duty) beyond the prices/wages prevailing at the time of the last stipulated date of receipt of tenders including extensions, if any, for the work during contract period including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, then the amount of the contract shall accordingly be varied.

If after submission of the tender, the price of any material incorporated in the works (excluding the materials covered under Clause 10CA and not being a material supplied from the Engineer-in- Charge's stores in accordance with Clause 10 thereof) and/or wages of labour as prevailing at the time of last stipulated date of receipt of tender including extensions, if any, is decreased as a direct result of the coming into force of any fresh law or statutory rules or order (but not due to any changes of rate in sales tax/VAT, Central/State Excise/Custom Duty), WAPCOS shall in respect of materials incorporated in the works (excluding the materials covered under Clause 10CA and not being material supplied from the Engineer-in-Charge's stores in accordance with Clause 10 hereof) and/or labour engaged on the execution of the work after the date of coming into force of such law statutory rule or order be entitled to deduct from the dues of the contractor, such amount as shall be equivalent to the difference between the prices of the materials and/or wages as prevailed at the time of the last stipulated date for receipt of tenders including extensions if any for the work and the prices of materials and/or wages of labour on the coming into force of such law, statutory rule or order. This will be applicable for the contract period including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2.

Engineer-in-Charge may call books of account and other relevant documents from the contractor to satisfy himself about reasonability of increase in prices of materials and wages.

The contractor shall, within a reasonable time of his becoming aware of any alteration in the price of any such materials and/or wages of labour, give notice thereof to the Engineer-in-Charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in position to supply.

For this purpose, the labour component of 85% of the value of the work executed during period under consideration shall not exceed the percentage as specified in Special Conditions of Contract, and the increase/decrease in labour shall be considered on the minimum daily wages in rupees of any unskilled Mazdoor, fixed under any law statutory role and order. The cost of work for which escalation is applicable (W) is same as cost of work done worked out as indicated in sub-para (ii) of clause 10 CC except the amount of full assessed value of secured Advance.

CLAUSE 10CA : PAYMENT DUE TO VARIATION IN PRICES OF MATERIALS AFTER RECEIPT OF TENDER -------- NOT APPLICABLE

If after submission of the tender, the price of materials specified in Special Conditions of Contract increases/ decreases beyond the base price(s) as indicated in Special Conditions of Contract for the work, then the amount of the contract shall accordingly be varied and provided further that any such variations shall be effected for stipulated period of Contract including the justified period extended under the provisions of Clause 5 of the Contract without any action under Clause 2.

However for work done/during the justified period extended as above, it will be limited to indices prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-rata basis only as cost of extra work x stipulated period/tendered cost).

The increase/decrease in prices of cement, steel reinforcement, structural steel and POL shall be determined by the Price indices Economic Advisor to Government of India, Ministry of Commerce and Industry. For other items provided in the Special Conditions of Contract, this shall be determined by the All India Wholesale Price Indices of materials as published by Economic Advisor to Government of India, Ministry of Commerce and Industry. Base price for cement, steel reinforcement, structural steel and POL shall be as issued by the state / Central Govt. from time to time. In case, price index of a particular material is not issued by Ministry of Commerce and Industry, then the price index of nearest similar material as indicated in Special Conditions of Contract shall be followed.

The amount of the contract shall accordingly be varied for all such materials and will be worked out as per the formula given Clause 10CA of General Conditions of Contract.

CLAUSE 10CC: PAYMENT DUE TO INCREASE/DECREASE IN PRICES/WAGES (EXCLUDING MATERALS COVERED UNDER CLAUSE 10 CA) AFTER RECEIPT OF TENDER FOR WORKS NOT APPLICABLE

If the prices of materials (not being materials supplied or services rendered at fixed prices by the WAPCOS in accordance with clause 10 & 34 thereof) and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provisions detailed below and the amount of the contract shall accordingly be varied, subject to the condition that that such compensation for escalation in prices and wages shall be available only for the work done during the stipulated period of the contract including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2. However, for the work done during the justified period extended as above, the compensation as detailed below will be limited to prices/wages prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-rata basis only as cost of extra work x stipulated period/tendered cost). No such compensation shall be payable for a work for which the stipulated period of completion

is equal to or less than the time as specified in Special Conditions of Contract. Such compensation for escalation in the prices of materials and labour, when due, shall be worked out based on the provisions mentioned in the Clause 10CC of General Conditions of Contract.

CLAUSE 10D : DISMANTLED MATERIAL WAPCOS PROPERTY

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as WAPCOS' property and such materials shall be disposed off to the best advantage of WAPCOS according to the instructions in writing issued by the Engineer-in-Charge.

CLAUSE 11 : WORKS TO BE EXECUTED IN ACCORDANCE WITH SPECIFICATIONS, DRAWINGS, ORDERS etc.

The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Engineer-in-Charge and the contractor shall be furnished free of charge one copy of the contract documents together with specifications, designs, drawings and instructions as are not included in the standard specifications specified in Special Conditions of Contract or in any Bureau of Indian Standard or any other, published standard or code or, Schedule of Rates or any other printed publication referred to elsewhere in the contract.

The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

At least to 10% of prescribed Tests as per Central Public Works Department Manual/IS Codes of construction materials shall be carried out from the outside approved/NABL recognized Laboratory as may be approved by WAPCOS without any extra expenditure to WAPCOS.

The Contractor shall establish a field test laboratory on the site with latest equipment's for carrying out field tests of construction materials and will maintain proper records of all the test results.

CLAUSE 12 : DEVIATIONS / VARIATIONS EXTENT AND PRICING

The Engineer-in-Charge shall have power (i) to make alteration in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

12.1 The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extended, if requested by the contractor, as follows:

(i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus

(ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

12.2 Payment of deviations/variations beyond 0.25% of the accepted tendered amount.

In case there is any change in scope as defined in the contract, the contractor shall carry out the changes as per direction of Engineer in Charge and nothing extra shall be payable to the contractor on account of same if the additional cost of such work is up to 0.25% (zero point two five percent) of the accepted tendered amount and worked out as per sub-clause 12.3 below. Variations/deviations upto 0.25% (zero point two five percent) of the accepted tendered amount shall be deducted from overall variations/ deviations for making payment.

12.3 DETERMINATION OF RATES

In the event, there is any deviations/variations in work as defined in the contract, the contractor shall submit the complete proposal to Engineer-in-charge within 15 days duly supported with :-

a) Analysis of rates for items involved, along with relevant documents, rates of materials, tools/plants and labour, etc.

b) The impact, if any, which the deviations/variations is likely to have on the project completion schedule,

On receipt of such proposal, either individually or covering group of items, the Engineer-in charge shall examine the proposal regarding its admissibility and finalize the proposal/rates within 45 days after receipt of proposal with all requisite details and documents from the contractors, after giving due consideration to the proposal, analysis and rates of materials and labours, etc.

12.3.1 The increase/decrease in the rates due to deviations/variations shall be decided based on the following criteria:-

- **Pricing of deviations**

a) If the item of work as stipulated in the schedule of quantity/scope of work deviates on plus side, then the rate for the deviated quantity shall be paid at the agreement rate upto the deviation limit as specified in Special Conditions of Contract with the same terms & conditions of the contract. Beyond deviation limit as specified in the Special Conditions of Contract, rate shall be payable on market rates to be determined based on the relevant documents and prevailing market rates, as per Para (ii) below

b)If the item of work as stipulated in the schedule of quantity/scope of work deviates on minus side, then the amount for such deviated quantity shall be deducted proportionately at the agreement rate.

- **Pricing of variations**

If there are changes in the quantity/specifications/ alterations/ substitutions/additions, etc. in the items, other than mentioned in para- (i) above, the rates shall be determined based on detailed analysis of rates with original stipulated scope of items & newly proposed/provided items. The difference of rates so determined shall be payable to/ recoverable from the contractor. The rates for both the components i.e. materials &labour shall be based on prevailing market rates. The rate finalized by the Engineerin-Charge shall be final and binding.

12.3.2 In case of either non-submission of timely proposal or incomplete proposal by the contractor for deviations/variations, the Engineer-in-Charge shall give final opportunity to the Contractor to submit the complete proposal for change of cost within next 15 days. In case of non- submission or further incomplete submission by the contractor within the stated period, the Engineer-in-Charge shall initiate the proposal and decide the change of cost. In such case the proposal finalized by the Engineer-in-Charge shall be final and binding on the contractor.

12.4 Restrictions on Deviations/Variations

i) Work(s) due to deviations/variations shall be executed only after getting the instructions of Engineer-in-charge, save except to meet any work of emergent nature.

iii) Notwithstanding anything to the contrary in this clause 12, any change arising from default of the contractor in the performance of his obligations under this agreement shall not be deemed to be deviations/variations, and shall not result in any adjustment of the contract price or the project completion schedule.

12.5(a) Deviations, Extra Items and Pricing

In the case of extra item(s) (items that are completely new, and are in addition to the items contained

in the contract), the contractor may within 15 (fifteen) days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, for the work and the engineer- in-charge shall within

prescribed time limit of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

12.5(b) Deviations, Substituted Items and Pricing.

In the case of substituted items (items that are taken up with partial substitution or in lieu of items of work in the contract), the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the following para.

(a) If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

(b) If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

CLAUSE 13 : FORECLOSURE OF CONTRACT DUE TO ABANDONMENT OR REDUCTION IN SCOPE OF WORK

If at any time after acceptance of the tender, Engineer-in-charge shall decide to abandon or reduce the scope of the works for any reason whatsoever and hence not require the whole or any part of the works to be carried out, the Engineer-in-Charge shall give notice in writing to that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The contractor shall be paid at contract rates, full amount for works executed at site and, in addition, a reasonable amount as certified by the Engineer-in-Charge for the items here under mentioned which could not be utilized on the work to the full extent in view of the foreclosure;

(i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labour huts, staff quarters and site office; storage accommodation and water storage tanks.

(ii) WAPCOS shall have the option to take over contractor's materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work). For materials taken over or to be taken over by WAPCOS, cost of such materials as detailed by Engineer-in- Charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the contractor.

(iii) If any materials supplied by WAPCOS are rendered surplus, the same except normal wastage shall be returned by the contractor to WAPCOS at rates not exceeding those at which these were originally issued, less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to WAPCOS stores, if so required by WAPCOS, shall be paid.

(iv) Reasonable compensation for transfer of T & P from site to contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.

The contractor shall, if required by the Engineer- in-Charge, furnish to him, books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

The reasonable amount of items on (i), (iii) and (iv) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor's materials at site taken over by the WAPCOS as per item (ii) above. Provided always that against any payments due to the contractor on this account or otherwise, the Engineer-in-Charge shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by the WAPCOS from the contractor under the terms of the contract.

A compensation for such eventuality, on account of damages etc. shall be payable @ 0.5% of cost of work remaining incomplete on date of closure i.e. total stipulated cost of the work less the cost of work actually executed under the contract shall be payable.

CLAUSE 14: CARRYING OUT PART WORK AT RISK & COST OF CONTRACTOR

If contractor:

(i) At any time makes default during currency of work or does not execute any part of the work with due diligence and continues to do so even after a notice in writing of 7 days in this respect from the Engineer-in-Charge; or

(ii) Commits default in complying with any of the terms and conditions of the contract and does not remedy it or takes effective steps to remedy it within 7 days even after a notice in writing is given in that behalf by the Engineer-in-Charge; or

(iii) Fails to complete the work(s) or items of work with individual dates of completion, on or before the date(s) so determined, and does not complete them within the period specified in the notice given in writing in that behalf by the Engineer-in-Charge. The Engineer- in- Charge without invoking action under clause 3 may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to WAPCOS, by a notice in writing to take the part work / part incomplete work of any item(s) out of his hands and shall have powers to:

(a) Take possession of the site and any materials, constructional plant, implements, stores, etc., thereon; and/or

(b) Carry out the part work / part incomplete work of any item(s) by any means at the risk and cost of the contractor.

The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractor for completion of the part work/ part incomplete work of any item(s) taken out of his hands and execute at the risk and cost of the contractor, the liability of contractor on account of loss or damage suffered by WAPCOS because of action under this clause shall not exceed 10% of the tendered value of the work.

In determining the amount, credit shall be given to the contractor with the value of work done in all respect in the same manner and at the same rate as if it had been carried out by the original

contractor under the terms of his contract, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor. The certificate of the Engineer-in-Charge as to the value of work done shall be final and conclusive against the contractor provided always that action under this clause shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the WAPCOS are less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

Any excess expenditure incurred or to be incurred by WAPCOS in completing the part work/ part incomplete work of any item(s) or the excess loss of damages suffered or may be suffered by WAPCOS as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to WAPCOS in law or per as agreement be recovered from any money due to the contractor on any account, and if such money is insufficient, the contractor shall be called upon in writing and shall be liable to pay the same within 30 days.

If the contractor fails to pay the required sum within the aforesaid period of 30 days, the Engineer- in-Charge shall have the right to sell any or all of the contractors' unused materials, constructional plant, implements, temporary building at site etc. and adjust the proceeds of sale thereof towards the dues recoverable from the contractor under the contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the contract.

In the event of above course being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made any advance on any account or with a view to the execution of the work or the performance of the contract.

CLAUSE 15: SUSPENSION OF WORK

(i) The contractor shall, on receipt of the order in writing of the Engineer-in-Charge, (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

(a) on account of any default on the part of the contractor or;

(b) for proper execution of the works or part thereof for reasons other than the default of the contractor; or

(c) For safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in- Charge.

(ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:

(a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

(b) If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Engineer-in-

Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within fifteen days of the expiry of the period of 30 days.

(iii) If the works or part thereof is suspended on the orders of the Engineer-in-Charge for more than three months at a time, except when suspension is ordered for reason (a) in sub para (i) above, the contractor may after receipt of such order serve a written notice on the Engineer-in-Charge requiring permission within fifteen days from receipt by the Engineer- in-Charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by WAPCOS or where it affects whole of the works, as an abandonment of the works by WAPCOS, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Engineer-in-Charge. In the event of the contractor treating the suspension as an abandonment of the contract by WAPCOS, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer-in-Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within 30 days of the expiry of the period of 3 months.

CLAUSE 16: ACTION IN CASE WORK NOT DONE AS PER SPECIFICATIONS

All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the inspection and supervision of the Engineer-ln-charge, his authorized subordinates in charge of the work and all the superior officers, officer of the Quality Assurance Unit of the WAPCOS or any organization engaged by the WAPCOS for Quality Assurance and of the Chief Technical Examiner's Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

If it shall appear to the Engineer-in-charge or his authorized subordinates incharge of the work or to the Chief Engineer in charge of Quality Assurance or his subordinate officers or the officers of the organization engaged by the WAPCOS for Quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within twelve months (six months in the case of work costing Rs. 10 Lac and below except road work) of the completion of the work from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his

own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause 2 of the contract (for non-completion of the work in time) for this default.

In such case the Engineer-in-Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the authority specified in Special Conditions of Contract may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

CLAUSE 17: CONTRACTOR LIABLE FOR DAMAGES, DEFECTS DURING DEFECT LIABILITY PERIOD

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within twelve months (six months in the case of work costing Rs. Ten lacs and below except road work) after a certificate final or otherwise of its completion shall have been given by the Engineer-in- Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit of the contractor shall not be refunded before the expiry of twelve months (six months in the case of work costing Rs. Ten lacs and below except road work) after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later.

Provided that in the case of road work, if in the opinion of the Engineer-in-Charge, half of the security deposit is sufficient, to meet all liabilities of the contractor under this contract, half of the security deposit will be refundable after six months and the remaining half after twelve months of the issue of the said certificate of completion or till the final bill has been prepared and passed whichever is later.

The defects liability period will be one year from the date of completion of development and construction works. During this period the Contractor will get the defects rectified without any cost to WAPCOS. For the item of water proofing roof treatment the Contractor will give guarantee bond for ten years. Similarly for other items, like electrical/mechanical equipment which have guarantee/warranty period beyond one year, wherever applicable as per manufacturer recommendations, will also be given guarantee bond by the Contractor to WAPCOS.

17.1 During Progress of Work

If the contractor or his working staff or workers damage any part of the work in the scope of contract, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass, grassland, cultivated ground, etc. contiguous to the premises on which the work or any part of it is being executed, the contractor shall make good the same at his own cost.

Contractor shall repair/replace and restore the damaged structures/services in a time bound manner as required and as directed by the Engineer-in-Charge. Contractor shall not be given any benefit of hindrance caused in the execution of the work owing to such damaged structure/service and time taken in its restoration by the contractor.

17.2 During Defect Liability Period

The contractor shall be responsible for all the defects and deficiencies in the work within the scope of this contract, during the defect liability period which shall be for 1 year after the date of actual completion of work as recorded by the Engineerin-Charge. The liability of contractor for defects and deficiencies may arise due to:

a) Improper planning and design of the project, if in the scope of contract.
b) Works, Tools, Plant & Machinery, Materials or Workmanship not being in accordance with this contract.
c) Improper upkeep & maintenance during construction of the work.
d) Improper upkeep, operation and/or maintenance during defect liability period, if these are in the scope of this contract.
e) Failure by the contractor to comply with any other obligation under this contract.

Such defects and deficiencies shall be made good by the contractor at his own cost after getting instructions/notice from the Engineer-in-Charge within the time period specified in such instructions/notice.

However, contractor need not wait for instructions/notice from Engineer-in-Charge for rectification of defects in work which come to his notice and he should initiate action for needful rectification of defect on priority, under intimation to Engineer-in-Charge, to avoid any untoward incident.

17.3 Structural Soundness

The contractor shall follow the good engineering practice for safety, serviceability and structural soundness of the building/ structure/road work etc. as covered in the scope of contract.

17.3.1 Structure design in the scope of contract

The contractor shall have obligation to rectify all defects in the structural elements or any other part of building/structure/road etc. due to design deficiency at his own cost for 10 (ten) years from the date of completion as recorded in the completion certificate by the Engineerin-Charge. Such defects shall be made good by the contractor at his own cost after getting instructions/notice from the Engineer-in-Charge within the time period specified in such instructions/notice and as per the methodology duly approved by the Engineer-in-Charge.

17.3.2 Structure design not in the scope of contract

The contractor shall not be liable for design deficiency.

17.3.3 Liability for execution

The contractor shall be fully liable for any deficiency in structural soundness of work owing to execution of the work under the scope of this contract. The contractor shall have obligation to rectify all defects in the structural elements owing to any deficiency in execution of work at his own cost for 10 (ten) years from the date of completion as recorded in the completion certificate by Engineer-in-Charge. Such defects shall be made good by the contractor at his own cost after getting instructions/notice from the Engineer-in-Charge within the time period specified in such instructions/notice and as per methodology duly approved by the Engineer- in-Charge.

17.4 Methodology for rectification of defects

The design, methodology and quality of rectification of defects carried out by the contractor shall be as per sound engineering practice.

17.5 Contractor's failure to rectify defects as defined in the sub-clauses 17.1, 17.2, 17.3 & 17.4

In the event that the contractor fails to repair or rectify the defect or deficiency within the period specified by the Engineer-in-Charge, the Engineer-in-Charge shall be entitled to get the same repaired, rectified or remedied

at the contractor's cost and recover such amount from any dues like performance guarantee, security deposits etc. available with Engineer-in-Charge. Engineer-in-Charge may take action for debarment of contractor from tendering in WAPCOS by following due process. For inaction or failure to rectify the defects covered under sub clause

17.3 within specified time limit, the Engineer-in-Charge may also initiate legal and/or other actions under other applicable laws in addition to other remedies available in the contract.

CLAUSE 18 : CONTRACTOR SUPPLY TOOLS & PLANTS ETC.

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-Charge's stores), machinery, tools & plants as specified in Special Conditions of Contract. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in

the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under this contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

CLAUSE 18A: RECOVERY OF COMPENSATION PAID TO WORKMEN

In every case in which by virtue of the provisions sub-section (1) of Section 12, of the Workmen's Compensation Act, 1923, WAPCOS is obliged to pay compensation to a workman employed by the contractor, in execution of the works, WAPCOS will recover from the contractor, the amount of the compensation so paid; and, without prejudice to the rights of the WAPCOS under sub-section (2) of Section 12, of the said Act, WAPCOS shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by WAPCOS to the contractor whether under this contract or otherwise. WAPCOS shall not be bound to contest any claim made against it under sub-section (1) of Section 12, of the said Act, except on the written request of the contractor and upon his giving to WAPCOS full security for all costs for which WAPCOS might become liable in consequence of contesting such claim.

CLAUSE 18B: ENSURING PAYMENT AND AMENITIES TO WORKERS, IF CONTRACTOR FAILS

ln every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, WAPCOS is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the rules under Clause 19H or under the C.P.W.D. Contractor's Labour Regulations, or under the Rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by C.P.W.D. Contractors, WAPCOS will recover from the contractor, the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the WAPCOS under sub-section(2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, WAPCOS shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by WAPCOS to the contractor whether under this contract or otherwise WAPCOS shall not be bound to contest any claim made against it under sub- section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the contractor and upon his giving to the WAPCOS full security for all costs for which WAPCOS might become liable in contesting such claim.

CLAUSE 19 : LABOUR LAWS TO BE COMPLIED BY CONTRACTOR

The contractor shall obtain a valid license under the Contract Labour (R&A) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with provisions of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.

The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfill these requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work

CLAUSE 19A

No labour below the age of fourteen years shall be employed on the work.

CLAUSE 19B : PAYMENT OF WAGES

i. The contractor shall pay to labour employed by him either directly or through subcontractors, wages not less than fair wages as defined in the C.P.W.D. Contractor's Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

ii. The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

iii. In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the Contractor's Labour Regulations made by WAPCOS from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

iv. (a) The Engineer-in-Charge concerned shall have the right to deduct from the moneys due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.

(b) Under the provision of Minimum Wages (Central) Rules, 1950, the contractor is bound to allow to the labours directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer-in-Charge concerned.

v. The contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, and the Contractor's Labour

(Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rules made thereunder from time to time.

vi. The contractor shall indemnify and keep indemnified WAPCOS against payments to be made under and for the observance of the laws aforesaid and the C.P.W.D. Contractor's Labour Regulations without prejudice to his right to claim indemnity from his sub-contractors.

vii. The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

viii. Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

ix. The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

CLAUSE 19C

In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per C.P.W.D. Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid, he shall be liable to pay a penalty of Rs.200/- for each default and in addition, the Engineer-in- Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19 D

The contractor shall submit by the 4th and 19th of every month, to the Engineer-in-Charge, a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively:-

(1) The number of labourers employed by him on the work,

(2) Their working yours,

(3) The wages paid to them,

(4) The accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and

(5) The number of female workers who have been allowed maternity benefit according to Clause 19F and the amount paid to them.

Failing which the contractor shall be liable to pay to WAPCOS, a sum not exceeding Rs.200/- for each default or materially incorrect statement. The decision of the Engineer-In-Charge shall be final in deducting from any bill due to the contractor; the amount levied as fine and be binding on the contractor.

CLAUSE 19 E

In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by the WAPCOS and its contractors.

CLAUSE 19 F

In the event of the contractor(s) committing a default or breach of any of the provisions of the WAPCOS, Contractor's Labour Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or

submitting or filing any statement under the provisions of the above Regulations and' Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the Government a sum not exceeding Rs.200/- for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to Rs.200/- per day for each day of default subject to a maximum of 5 per cent of the estimated cost of the work put to tender. The decision of the Engineer-in-Charge shall be final and binding on the parties.

Should it appear to the Engineer-in-Charge that the contractor(s) is/are not properly observing and complying with the provisions of the C.P.W.D. Contractor's Labour Regulations and Model Rules and the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (R& A) Central Rules 1971, for the protection of health and sanitary arrangements for work- people employed by the contractor(s) (hereinafter referred as "the said Rules") the Engineer -in- Charge shall have power to give notice in writing to the contractor(s) requiring that the said Rules be complied with and the amenities prescribed therein be provided to the work-people within a reasonable time to be specified in the notice. If the contractor(s) shall fail within the period specified in the notice to comply with and/observe the said Rules and to provide the amenities to the work- people as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities hereinbefore mentioned at the cost of the contractor(s). The contractor(s) shall erect, make and maintain at his/their own expense and to approved standards all necessary huts and sanitary arrangements required for his/their work-people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said huts and sanitary arrangements be remodelled and/or reconstructed according to approved standards, and if the contractor(s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor(s).

CLAUSE 19 G

The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Engineer-in-Charge.

(i) (a) The minimum height of each hut at the eaves level shall be 2.10m (7 ft.) and the floor area to be provided will be at the rate of 2.7 sq.m. (30 sq.ft.) for each member of the worker's family staying with the labourer.

(b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6'x5') adjacent to the hut for each family.

(c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.

(d) The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

(ii) (a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in-Charge. In case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer-in-Charge and the contractor shall ensure that throughout the period of their occupation, the roofs remain

water-tight.

(b) The contractor(s) shall provide each hut with proper ventilation.

(c) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.

(d) There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Engineer-in-Charge. Back to back construction will be allowed

(iii) **Water Supply** - The contractor(s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The contractor(s) shall also at his/ their own cost make arrangements for laying pipe lines for water supply to his/ their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.

(iv) The site selected for the camp shall be high ground, removed from jungle.

(v) **Disposal of Excreta** - The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

(vi) **Drainage** - The contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

(vii) The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

(viii) **Sanitation -** The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

CLAUSE 19 H

The Engineer-in-Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractors' employ upon the work who may be incompetent or misconduct himself and the contractor shall forthwith comply with such requirements. In respect of maintenance/repair or renovation works etc. where the labour have an easy access to the individual houses, the contractor shall issue identity cards to the labourers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labour. AE/JE will display a list of contractors working in the colony/Blocks on the notice board in the colony and also at the service centre, to apprise the residents about the same.

CLAUSE 19 I

It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorized during construction, and is handed over to the Engineer-in- Charge with vacant possession of complete building. If such building though completed is occupied illegally, then the Engineer-in-Charge shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay, a levy upto 5% of tendered value of work may be imposed by the WAPCOS whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However, WAPCOS, through a notice, may require the contractor to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 19 J: Employment of Skilled / Semi Skilled Workers

The contractor shall, at all stages of work, deploy skilled/semi-skilled tradesmen who are qualified and possess certificate in particular trade from Industrial Training Institute/National Institute of construction Management and Research (NICMAR)/ National Academy of Construction, CIDC or any similar reputed and recognized Institute managed/ certified by State/Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled/semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, it's scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer in charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer in Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding. Provided always, that the provisions of this clause, shall not be applicable for works with estimated cost put to tender being less than Rs. 5 crores.

Clause 19K: Contribution of EPF and ESI- NOT APPLICABLE

The ESI and EPF contributions on the part of employer in respect of this contract shall be paid by the contractor. These contributions on the part of the employer paid by the contractor shall be reimbursed by the Engineer-in-charge to the contractor on actual basis. The verification of deployment of labour will be done through biometric attendance system or any other suitable method by the Engineer in Charge. The applicable and eligible amount of EPF & ESI shall be reimbursed preferably within 7 days but not later than 30 days of submission of documentary proof of payment provided same are in order.

CLAUSE 20 : MINIMUM WAGES ACT TO BE COMPLIED WITH

The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, and Contract Labour (Regulation and Abolition) Act, 1970, amended from time to time and rules framed thereunder and other labour laws affecting contract labour that may be brought into force from time to time.

CLAUSE 21 : WORK NOT TO BE SUBLET. ACTION IN CASE OF INSOLVENCY

The contract shall not be assigned or sublet without the written approval of the Engineer-in Charge. And if the contractor shall assign or sublet his contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public officer or person in the employ of WAPCOS in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer-in-Charge on behalf of the WAPCOS shall have power to adopt the course specified in Clause 3 hereof in the interest of WAPCOS and in the event of such course being adopted, the consequences specified in the said Clause 3 shall ensue.

CLAUSE 21-A

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of WAPCOS without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

CLAUSE 22: QUALITY ASSURANCE AND SUPERVISION FOR EXECUTION PART of WORK

22.1 Quality of Materials and Workmanship

i) The Contractor shall ensure that the Materials and workmanship are in accordance with the requirements specified in this Agreement, Specifications and Standards and Sound Engineering practice. The work shall be of the specified quality and standard, both in respect of ingredients as well as the intended functions it is supposed to perform for service life.

ii) The Contract warrants that all Materials shall be new, unused, not reconditioned, unless otherwise allowed as per contract or by Engineer-in-Charge, and in conformity with Specification and Standards, Applicable Laws and Sound Engineering Practice, and that the Contractor shall not use any materials which are generally recognized as being deleterious under Sound Engineering Practice.

22.2 Quality Assurance System

The Contractor shall devise a quality assurance mechanism to ensure compliance with the provisions of this Agreement (the "Quality Assurance Plan" or "QAP").

i) The Contractor shall, submit to the Engineer-in-Charge, its Quality Assurance Plan 15 (fifteen) days in advance of start of the execution stage specified in the NIT. The Engineer-in-Charge shall convey its comments to the Contractor within a period of 7 (seven) days of receipt of the QAP stating the modifications, if any, required and the Contractor shall incorporate those in the QAP conforming with the provisions of this clause. The QAP shall include the following:

a) Contractor's Organization & structure, duties and responsibilities of individual key personnel, quality policy of contractor, procedure for control of non-conformities and corrective action, inspections and documentation

b) Internal quality audit system.

c) Machinery, Shuttering, other Tool & Plants, etc. required to be deployed at site.

d) Method statement of important activities. These can be submitted as per the sequencing of the activities of the work.

e) Quality control mechanism including sampling and testing of Materials, test frequencies, standards, acceptance criteria, testing facilities, reporting, recording and interpretation of test results, approvals, proforma for testing and calibration in accordance with the Specifications and Standards and Sound Engineering Practice; and Material Lot size, number of required tests and frequency of testing for different construction materials.

All the relevant and applicable codes, specifications and standards, as well as the acceptance criteria for various items of work, workmanship, materials and process employed needs to be mentioned.

f) Check-list for various items and materials.

g) Formats for site documentation, monthly reports on implementation of QAP.

(ii) Sampling of materials

All samples of materials including Cement Concrete Cubes shall be taken by the QA engineers deployed by the Contractor and shall be witnessed by the Engineer-in Charge or his authorized representatives as specified in NIT. All the necessary assistance, facilities and safety shall be provided by the contractor. Cost of sample of materials and testing charges shall be borne by the contractor and he/she is responsible for safe custody of samples to be tested at site.

(iii) Testing of Materials

The contractor shall establish temporary field laboratory of adequate size with all necessary facilities. Field laboratory shall be equipped with the testing equipment for conducting routine field tests as per this contract. It will also have copies of standards, BIS codes, IRC codes, relevant publications.
All the tests in field lab setup at construction site shall be carried out by the QA Staff deployed by the contractor and shall be witnessed by the Engineer-in-Charge or his authorized subordinates as specified in NIT. The contractor shall provide all necessary facility to them for witnessing the tests in the field laboratory. In general, contractor shall carry out 90% of field tests in site laboratory and 10% tests shall be got carried out from outside laboratory as indicated below. Contractor shall endeavour to obtain test reports for tests conducted from outside laboratory in a reasonable time.

iv) Maintenance of Register of Test –

- All the entries in the register of test are to be made by the designated QA Engineers of the contractor and same is to be regularly reviewed by the field officers as well as the Engineer-in-Charge. The contractor shall allow inspection of such records any time as desired by Engineer-in-Charge or his authorized representative.
- All the tests carried out at construction site or outside laboratories are to be maintained by the contractor in the prescribed format in the test registers provided by the contractor and duly authenticated by Engineer-in-Charge. The test reports shall also be maintained in hard file.
- Contractor is responsible for maintenance and safe custody of all the test registers and test records.
- Mandatory test conducted as per approved proforma shall be attached with each Running bill. Submission of copy of all test registers and material at site register along with each alternate Running Account Bill and with Final Bill is mandatory.

v) Maintenance of Material at Site (MAS) Register-

MAS register of the key materials including Cement and Steel Registers shall be maintained in the proforma approved by Engineer-in-Charge. All the entries in the MAS registers are made by the designated staff of the contractor and same is regularly reviewed by the field officers as well as the Engineer-in-Charge. Contractor is responsible for maintenance and safe custody of MAS registers.

(vi) The Contractor shall procure all relevant codes, publications, apparatus and instruments, fuel, consumables, water, electricity, labour, materials, samples and qualified personnel as are necessary for examining and testing the Works, Materials and workmanship in accordance with the Quality Assurance Plan.

(vii) All the cost of testing including cost of samples, packaging, transportation, testing charges of Construction, Materials and workmanship under this clause shall be borne by the contractor.
(viii)The contractor shall submit monthly quality progress report on implementation of the provisions of Quality Assurance Plan on the format approved by the Engineer-inCharge.

22.3 Samples

The Contractor shall, at its own expense and without delay, provide the samples of Materials and relevant information like Manufacturer's test reports, standard samples of manufactured
Materials and Samples of such other Materials as the Engineer-in- Charge may require for review and approvals in accordance with Clause 10A of GCC before actual use.

22.4 Test

(i) For determining that the Works conform to the Specifications and Standards, the Engineer-in-Charge shall require the Contractor to carry out or cause to be carried out tests, at such time and frequency and in such manner as specified in this Agreement and in accordance with sound engineering practice for quality assurance. Frequency and the manner in which tests shall be conducted shall be in the following order of preference:

a) Contract provisions.
b) CPWD specifications.
c) BIS codes.
d) IRC codes.
e) MoRTH Specifications.
f) International Codes.
g) Manufacturer's specifications.

Outside tests shall be conducted at Government labs /IITs/NITs and other approved laboratories by the Engineer-in-Charge for testing of materials

(ii) The Contractor shall, with due diligence, carry out all the tests in accordance with the Agreement and furnish the results thereof to the Engineer-in-Charge. The Engineer- nCharge or his authorized representative shall witness or participate during the testing as specified in NIT. The contractor shall provide all necessary assistance for witnessing/participating in the field tests.

(iii) In the event that results of any tests conducted under this clause establish any defects or deficiencies in the Works, the Contractor shall carry out remedial measures at its own cost and furnish a report to the Engineer-in-Charge in this regard. The Engineer-in Charge shall require the Contractor to carry out or cause to be carried out tests to determine that such remedial measures have brought the works into compliance with the Specifications and standards and the procedure shall be repeated until such Works conform to the Specifications and Standards

22.5 Method Statement

The 'Method statement' is a statement by which the construction procedures for important activities are stated, checked, and approved. The method statement shall be prepared for important activities as identified by the contractor as mentioned in QAP or any other activity as instructed by Engineer-in Charge. The 'Method statement', should have a description of the item with elaborate procedure in steps to implement the same, the specifications of the materials involved, equipment to be deployed, measures for ensuring safety, their testing and acceptance criteria, precautions to be taken, mode of measurement, etc. The Contractor shall, at least 15 (fifteen) days prior to the commencement of activities, submit to the Engineer-in Charge for review, the method statements proposed to be adopted for executing the various items of work. The Engineer-in-Charge shall complete the review and convey its comments, if any, to the Contractor within a period of 07 (seven) days from the date of receipt of the proposed methodology from the Contractor.

22.6 Inspection & review by the Engineer-in-Charge and External Audit.

The Engineer-in-Charge, his authorized subordinates, senior officers of WAPCOS, QA unit or any other third party may inspect and review the progress and quality of the work and issue appropriate directions to the Contractor for taking remedial action in the event the work is not in accordance with the provisions of this Agreement. The work may be inspected at any time/stage by external inspection teams like CTE or TE, Third Party Quality assurance agency, CPWD team etc. may conduct inspection of the quality of the works. The findings of the inspections shall be notified to the Contractor for taking remedial action in accordance with the agreement. The Contractor shall provide all assistance as may be required by the inspection teams in the conduct of its inspection here under Suitable actions shall be taken as per the provisions contained in the relevant clauses of the agreement, if the work is not found to be as per specifications or quality as specified in the agreement.

22.7 Inspection of records

The Engineer-in-Charge or his authorized representative shall have the right to inspect the records of the Contractor relating to the works.

22.8 Inspection of Works

(i) The Engineer-in-Charge and his authorized subordinates shall at all times;

(a) have full access to all parts of the site and to all places from which natural materials are being obtained for use in the works; and

(b) during production, manufacture and construction at the site and at the place of production, be entitled to examine, inspect, measure and test the materials and workmanship and to check the progress of the manufacturer of Materials.
(ii) The Contractor shall give the Engineer-in-Charge and its authorized representative access, facilities and safety equipment for carrying out their obligations under this Agreement.

22.9 Examination of work before covering up/ Test Check of item of Work
In respect of the work which the Engineer-in-Charge or his authorized representatives are required to examine, inspect, measure or test before it is covered up or put out of view or any part of the work is placed thereon, the Contractor shall give notice to the Engineer-in-Charge whenever any such work is ready and before it is covered up. The Engineer-in-Charge shall then either carry out the examination, inspection or testing without unreasonable delay within 7 days, or promptly give notice to the Contractor that the Engineer-in-Charge does not require him to do so. Provided, however, that if any work is of a continuous nature where it is not possible or prudent to keep it uncovered or incomplete, the Contractor shall notify the schedule of carrying out such work to give sufficient opportunity, not being less than 3(three) business days' notice, to the Engineer-in-Charge to conduct its inspection, measurement or test while the work is continuing. Provided further that in the event the Contractor receives no response from the Engineer-in-Charge within a period of 3 (three) business days from the date on which the Contractor's notice hereunder is delivered to the Engineer-in Charge, the Contractor shall be entitled to assume that the Engineer-in-Charge would not undertake the said inspections.

22.10 Rejection
(i) If, as a result of an examination, inspection, measurement or testing, any Plant, Materials, design or workmanship is found to be defective or otherwise not in accordance with the provisions of this Agreement, the Engineer-in-Charge may reject such piece of work, Plant, Materials, design or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the requirements of this Agreement.
(ii) If the Engineer-in-Charge requires a Piece of work, Plant, Material, design or workmanship to be retested, the tests shall be repeated on the same terms and conditions, as applicable in each case. If the rejection and retesting cause the WAPCOS to incur any additional costs, such costs shall be recoverable by the Engineer-in-Charge from the Contractor and may be deducted by the Engineerin-Charge from any amount due to be paid to the Contractor.
(iii) The Contractor shall not be entitled to any extension of time on account of rectifying any defect or retesting as specified in this clause.
(iv) Examination, inspection, measurement or testing of any Plant, Material, design or workmanship by the Engineer-in-Charge or its failure to convey its observations or to examine, inspect, measure or test shall neither relieve the Contractor of its obligations and liabilities under this Agreement in any manner nor shall the Engineer-in-Charge be liable for the same in any manner.

22.11 Remedial Work
(i) Notwithstanding any previous test or certification, the Engineer-in-Charge may instruct
the Contractor to:

(a) remove from the site and replace any piece of work,plant or materials which are not in accordance with the provisions of this Agreement.

(b) remove and re-execute any work which is not in accordance with the provisions of this Agreement and the Specification and Standards; and

(c) execute any work which is urgently required for the safety of the Project, whether because of an accident, unforeseeable event or otherwise.

(ii) If the Contractor fails to comply with the instructions issued by the Engineer-inCharge under aforesaid para, within the time specified in the notice or as mutually agreed, the Engineer-in-Charge may get the work executed by another agency. The cost so incurred by the Engineer-in-Charge for undertaking such work shall, without prejudice to the rights of the Engineer-in-Charge to recover damages in accordance with the provisions of this

Agreement, be recoverable from the Contractor and may be deducted by the Engineerin-Charge from any amount due to be paid to the Contractor

22.12 Quality Control Records

The Contractor shall hand over authenticated copy of all its quality control records and documents to the Engineer-in-Charge before the Completion Certificate is issued.

22.13 Video recording

During the Construction Period, the Contractor shall provide to the Engineer-inCharge for every calendar quarter, a video recording which will be compiled into a 15 (fifteen) minutes digital video covering the status and progress of work in that quarter. Video recording should show different activities, stage of work, quality assurance activities etc. including animation, graphs, digital maps, commentary, sub titles, etc. spread over the quarter. The video recording shall be provided to the Engineerin-Charge no later than 15 (fifteen) days after the close of each quarter to be reckoned from next full month of date of start of work.

22.14 Suspension of unsafe Construction Works

(i) Upon recommendation of the Engineer-in-Charge to this effect, or on his own volition in cases of emergency or urgency, the Engineer-in-Charge may by notice require the Contractor to suspend forthwith the whole or any part of the Works if, in the reasonable opinion of Engineer-in-Charge, as the case may be, such work threatens the safety of the Users and or other persons on or about the Project. Provided, however, that in case of an emergency, the Engineer-in-Charge may suomoto issue the notice referred to hereinabove.

(ii) The Contractor shall, pursuant to the notice underabove para, suspend the Works or any part thereof for such time and in such manner as may be specified by the Engineer-in-Charge and thereupon carry out remedial measures to secure the safety of suspended works, the Users, other persons and vehicles on or about the Project. The Contractor by notice require the Engineer-in-Charge to inspect such remedial measures forthwith and request for revocation of suspension. Upon reviewing the remedial measures, the Engineer-in-Charge shall either revoke such suspension or instruct the Contractor to carry out such other and further remedial measures as may be necessary and reasonable and the procedure set forth in this Clause shall be repeated until the suspension hereunder is revoked.

(iii) Subject to other provisions of the agreement, all reasonable cost incurred for maintaining and protecting the Works or part thereof during the period of suspension (the “Preservation Costs”) shall be borne by the contractor, if in the opinion of Engineer-in-Charge suspension is on account of reasons attributable to the contractor.

(iv) If suspension of Work is for reasons not attributable to the Contractor, the Engineerin-Charge shall determine any Time Extension, if required, in accordance with the provisions of clause-5.

22.15 Online maintenance of Site records including testing records.

(i) The Engineer-in-Charge may require the contractor to upload all the site records in any online system devised by him. The contractor shall have to ensure that all the required site records, as desired by the Engineer-in-Charge shall be uploaded in this online system. Nothing extra on this account shall be payable to the contractor. In case these records are to be maintained in any online module then contractor shall comply with this.

CLAUSE 23 : CHANGES IN FIRM’S CONSTITUTION TO BE INTIMATED

Where the contractor is a partnership firm, the previous approval in writing of the Engineer-in- Charge shall be obtained before any change is made in the constitution of the firm. Where the contractor is a Proprietor Firm, such approval as aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If previous approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 hereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

CLAUSE 24 : LIFE CYCLE COST

The contractor shall be responsible for safety, quality and soundness of the buildings including structural elements beyond maintenance period. The contractor shall have obligation to rectify such defects minimum up to 5 (five) years from the date of completion of work. The defects have to be rectified within a reasonable time not exceeding forty five days after issue of notice by Engineer- in-Charge. If contractor does not take corrective action within 45 days, then action for debarring of the agency shall be taken by the appropriate authority.

All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Engineer-in-Charge who shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

CLAUSE 25 : SETTLEMENT OF DISPUTES & ARBITRATION

Amicable Resolution and Mediation

Save where expressly stated to the contrary in the Contract, any dispute, difference or controversy of whatever nature between the Parties, howsoever arising under, out of or in relation to the Contract including disputes, if any, with regard to any acts, decision or opinion of WAPCOS Limited Representative and so notified in writing by either Party to the other (the "Dispute") shall in the first instance be attempted to be resolved amicably in accordance with the procedure set out in Clause 25.1 [Amicable Resolution and Mediation] below.

Clause 25.1 :

Either Party may require such Dispute to be referred to a person nominated by each Party, for amicable settlement. Upon such reference, the two shall meet at the earliest mutual convenience and in any event within [15 (fifteen)] days of such reference to discuss and attempt to amicably resolve the Dispute.

In the event that the Dispute in question is not resolved amicably within 15 (fifteen) days of such meeting between the Parties in accordance with Clause 25.1 [Amicable Resolution and Mediation] either Party may refer the Dispute to arbitration in accordance with Clause 25.2 [Arbitration Procedure].

Clause 25.2 : Arbitration Procedure

Save where expressly stated to the contrary in the Contract, any Dispute shall be finally settled by binding arbitration under the Arbitration and Conciliation Act 1996 by sole arbitrators appointed by CMD, WAPCOS.

Place of Arbitration

The place of arbitration shall be New Delhi.

English Language

The request for arbitration, the answer to the request, the terms of reference, any written submissions, any orders and awards shall be in English and, if oral hearings take place, English shall be the language to be used in the hearings.

Enforcement of Award

The Parties agree that the decision or award resulting from arbitration shall be final and binding upon the Parties and shall be enforceable in accordance with the provisions of the Arbitration and Conciliation Act.

Performance during Arbitration

Pending the submission of and/or decision on a Dispute and until the arbitral award is published, the Parties shall continue to perform their respective obligations under the Contract without prejudice to a final adjustment in accordance with such award.

Except where otherwise provided in the contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter:

"Any dispute, Controversy of claims arising out of or relating to this Agreement or the breach, termination or invalidity thereof, shall be settled through following mechanism:

a. Firstly, the aggrieved party shall write a letter to the other party detailing its grievances and calling upon the other party to amicably resolve the dispute by convening a joint meeting. Accordingly, the parties as per their convenience shall jointly convene the said meeting(s), wherein minutes of the said meeting(s) shall be prepared and countersigned by all the parties. It is mandatory to prepare minutes of meeting(s) and to be countersigned by all the parties, irrespective of the outcome of the said meeting(s).

b. In the event the parties are unable to reach on my settlement in the said meeting(s), then the aggrieved party shall mandatory resort to pre-litigation mediation mechanism with Delhi High Court Mediation Cell, New Delhi.

c. It is only upon failure of the pre-litigation mediation mechanism with Delhi High Court Mediation Cell, then the aggrieved party shall resort to resolution of disputes through arbitration of a Sole Arbitrator. The appointing authority of Sole Arbitrator is CMD, WAPCOS Limited, to which neither of the parties have any objection nor they shall ever object.

d. Subject to the parties agreeing otherwise, the Arbitration proceedings shall be conducted in accordance with the provisions of the Indian Arbitration and Conciliation Act, 1996 (amended as on date).

e. It is also acknowledged and accepted that WAPCOS is only working as Intermediary between the Associate/Sub-Consultant/Sub-Contractor and the Principal Employer/Client, thus in the event, any dispute arises under the present agreement and referred to arbitration for adjudication, then subject to corresponding clause in

the contract/agreement/work order/agreement between Principal Employer/Client & WAPCOS. Principal Employer/Client shall also be made party to the said arbitration proceedings. Also, the award including costs if any passed against WAPCOS and costs incurred in the proceedings shall be the sole responsibility of Principal Employer/Client. The said clause if found inapplicable, even then the other terms of the arbitration clause shall survive and shall be acted upon.

f. The place/seat of arbitration shall be Delhi and any award weather interim or final, shall be made, and shall be deemed for all purpose between the parties to be made, in Delhi. The arbitration procedure shall be conducted in English language and any award or awards shall be rendered in English. The procedural law of the arbitration shall be Indian law. The award of the arbitrator shall be final and conclusive and binding upon the Parties.

g. The Contract and any dispute or claim arising out of or in connection with it or its subject matter of formation (including non-contractual disputes or claims) shall be governed by and construed in accordance with the laws of India and the Parties submit to sole & exclusive jurisdiction of courts at Delhi."

CLAUSE 26: CONTRACTOR INDEMNIFY WAPCOS AGAINST PATENT RIGHTS

The contractor shall fully indemnify and keep indemnified the WAPCOS against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under or action brought against WAPCOS in respect of any such matters as aforesaid, the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise therefrom, provided that the contractor shall not be liable to indemnify the WAPCOS if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer-in-Charge in this behalf.

CLAUSE 27: LUMPSUM PROVISIONS IN TENDER----------NOT APPLICABLE

When the estimate on which a tender is made includes lump sum in respect of parts of the work, the contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract for such items, or if the part of the work in question is not, in the opinion of the Engineer-in-Charge payable of measurement, the Engineer-in-Charge may at his discretion pay the lump-sum amount entered in the estimate, and the certificate in writing of the Engineer-in-Charge shall be final and conclusive against the contractor with regard to any sum or sums payable to him under the provisions of the clause.

CLAUSE 28: ACTION WHERE NO SPECIFICATIONS ARE SPECIFIED

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case there are no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturers' specifications, if not available then as per District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-Charge.

CLAUSE 29: WITHOLDING AND LIEN IN RESPECT OF SUM DUE FROM CONTRACTOR

a) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer-in-Charge or the WAPCOS shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer-in- Charge or the WAPCOS shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Engineer-in-Charge or the WAPCOS shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter become payable to the contractor under the same contract or any other contract with the Engineer-in-Charge of the WAPCOS or any contracting person through the Engineer-in-Charge pending finalization of adjudication of any such claim. It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer-in-Charge or WAPCOS will be kept withheld or retained as such by the Engineer-in-Charge or WAPCOS till the claim arising out of or under the contract is determined by the arbitrator(if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Engineer-in-Charge or the WAPCOS shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.

b) WAPCOS shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract, etc., to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of over- payment and it shall be lawful for WAPCOS to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by WAPCOS to the contractor, without any interest thereon whatsoever.

Provided that the WAPCOS shall not be entitled to recover any sum overpaid, nor the contractor shall be entitled to payment of any sum paid short where such payment has been agreed upon between the WAPCOS on the one hand and the contractor on the other under any term of the contract permitting payment for work after assessment by WAPCOS.

CLAUSE 29A : LIEN IN RESPECT OF CLAIMS IN OTHER CONTRACTS

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or the WAPCOS or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or WAPCOS or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer-in-Charge or the WAPCOS or with such other person or persons. It is an agreed term of the contract that

the sum of money so withheld or retained under this clause by the Engineer-in- Charge or the WAPCOS will be kept withheld or retained as such by the Engineer-in-Charge or the WAPCOS or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 29B: EMPLOYMENT OF COAL MINING OR CONTROLLED AREA LABOUR NOT PERMISSIBLE ---------NOT APPLICABLE

The contractor shall not employ coal mining or controlled area labour falling under any category whatsoever on or in connection with the work or recruit labour from area within a radius of 32 km (20 miles) of the controlled area. Subject as above the contractor shall employ imported labour only i.e., deposit imported labour or labour imported by contractors from area, from which import is permitted.

Where ceiling price for imported labour has been fixed by State or Regional Labour Committees not more than that ceiling price shall be paid to the labour by the contractor.

The contractor shall immediately remove any labourer who may be pointed out by the Engineer-in-Charge as being a coal mining or controlled area labourer. Failure to do so shall render the contractor liable to pay to WAPCOS a sum calculated at the rate of Rs.10/- per day per labourer. The certificate of the Engineer-in-Charge about the number of coal mining or controlled area labourer and the number of days for which they worked shall be final and binding upon all parties to this contract.

It is declared and agreed between the parties that the aforesaid stipulation in this clause is one in which the public are interested within the meaning of the exception in Section 74 of Indian Contract Act, 1872.

Explanation:- Controlled Area means the following areas:
Districts of Dhanbad, Hazaribagh, Jamtara - a Sub-Division under Santhal Pargana Commissionery, Districts of Bankuara, Birbhum, Burdwan, District of Bilaspur.

Any other area which may be declared a Controlled Area by or with the approval of the Central Government.

CLAUSE 30 : WATER FOR WORKS

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

(i) That the water used by the contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer-in-Charge.

(ii) The Engineer-in-Charge shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Engineer-in- Charge, unsatisfactory.

CLAUSE 30A: WATER SUPPLY, IF AVAILABLE – NOT APPLICABLE

Water if available may be supplied to the contractor by the WAPCOS subject to the following conditions:-

(i) The water charges @ 1 % shall be recovered on gross amount of the work done.

(ii) The contractor(s) shall make his/their own arrangement of water connection and laying of pipelines from existing main of source of supply.

(iii) The WAPCOS do not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor(s) to make alternative arrangements for water at his/ their own cost in the event of any temporary break down in the water main so that the progress of

his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.

CLAUSE 30B : ALTERNATE WATER ARRANGEMENTS---------- NOT APPLICABLE

(i) Where there is no piped water supply arrangement and the water is taken by the contractor from the wells or hand pump constructed by the Government, no charge shall be recovered

from the contractor on that account. The contractor shall, however, draw water at such hours of the day that it does not interfere with the normal use for which the hand pumps and wells are intended. He will also be responsible for all damage and abnormal repairs arising out of his use, the cost of which shall be recoverable from him. The Engineer-in-Charge shall be the final authority to determine the cost recoverable from the contractor on this account and his decision shall be binding on the contractor.

(ii) The contractor shall be allowed to construct temporary wells in the proposed land for Construction for taking water for construction purposes only after he has got permission of the Engineer-in- Charge in writing. No charges shall be recovered from the contractor on this account, but the contractor shall be required to provide necessary safety arrangements to avoid any accidents or damage to adjacent buildings, roads and service lines. He shall be responsible for any accidents or damage caused due to construction and subsequent maintenance of the wells and shall restore the ground to its original condition after the wells are dismantled on completion of the work.

CLAUSE 31: HIRE OF PLANT & MACHINERY

The contractor shall arrange at his own expense all tools, plant, machinery and equipment (hereinafter referred to as T&P) required for execution of the work.

CLAUSE 32: EMPLOYMENT OF TECHNICAL STAFF AND EMPLOYEES

Contractors Superintendence, Supervision, Technical Staff & Employees

(i) The contractor shall provide all necessary superintendence during execution of the work and all along thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The contractor shall immediately after receiving letter of acceptance of the tender and before commencement of the work, intimate in writing to the Engineer-in-Charge, the name(s), qualifications, experience, age, address(s) and other particulars along with certificates, of the principal technical representative to be in charge of the work and other technical representative(s) who will be supervising the work. Even of the contractor (or partner(s) in case of firm/ company) is himself / herself an Engineers, it is necessary on the part of the contractor to employ principal technical representative / technical representative (s).

The Engineer-in-Charge shall within 3 days of receipt of such communication intimate in writing his approval or otherwise of such a representative(s) to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the contractor shall appoint another such representative(s) according to the provisions of this clause. Decision of the tender accepting authority shall be final and binding on the contractor in this respect. Such a principal technical representative and other technical representative(s) shall be appointed by the contractor soon after receipt of the approval from Engineer-in-charge and shall be available at site before start of work.

All the provisions applicable to the principal technical representative under the Clause will also be applicable to other technical representative(s) The principal technical representative and other technical representative(s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself/themselves, as required, to the Engineer-in-Charge and/or his designated representative to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the contractor. The principal technical representative

and other technical representative(s) shall be actually available at site fully during all stages of execution of work, during recording/checking/test checking of measurements of works and whenever so required by the Engineer-in-Charge and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative(s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements/checked measurements/ test checked measurements. The representative(s) shall not look after any other work. Substitutes, duly approved by Engineer-in-Charge of the work in similar manner as aforesaid shall be provided in event of absence of any of the representative(s) by more than two days.

If the Engineer-in-Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative(s) is/are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non-refundable) shall be effected from the contractor and the decision of the Engineer-In-Charge as recorded in the site order book and measurement recorded checked/test checked in Measurement Books shall be final and binding on the contractor. Further if the contractor fails to appoint suitable technical Principal technical representative and/or other technical representative(s) and if such appointed persons are not effectively present or are absent by more than two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in-Charge shall have full powers to suspend the execution of the work until such date as suitable other technical representative(s) is/are appointed and the contractor shall be held responsible for the delay so caused to the work. The contractor shall submit a certificate of employment of the technical representative(s) (in the form of copy of Form-16 or CPF deduction issued to the Engineers employed by him) along with every on account bill/ final bill and shall produce evidence if at any time so required by the Engineer- in-Charge.

(ii) The contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.

The contractor shall provide and employ skilled, semiskilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in- Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 33: LEVY/TAXES PAYABLE BY CONTRACTOR

i. GST, Building and other Construction Workers Welfare Cess or any other tax, levy or Cess in respect of input for or output by this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect except as provided under Clause 34.

ii. The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar, etc. from local authorities.

If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the Government of India and does not any time become payable by the contractor to the State Government, Local authorities in respect of any material used by the contractor in the works, then in such a case, it shall be lawful to the Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor

CLAUSE 34 : CONDITIONS FOR REIMBURSEMENT OF LEVY/TAXES IF LEVIED AFTER RECEIPT OF TENDERS

(i) All tendered cost shall be inclusive of all taxes and levies (except GST) payable under respective statutes. However, if any further tax or levy or cess is imposed by Statute, after the last stipulated date for the receipt of tender including extensions if any and the contractor thereupon necessarily and properly pays such taxes/levies/cess, the contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the WAPCOS attributable to delay in execution of work within the control of the contractor.

However, effect of variation in rates of GST or Building and Other Construction Workers Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease.

Provided further that for Building and Other Construction Workers Welfare Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/cess.

Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by WAPCOS for extension of time.

(ii) The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the Government and/or the Engineer-in-Charge and shall also furnish such other information/document as the Engineer-in-Charge may require from time to time.

(iii) The contractor shall, within a period of 30 days of the imposition of any such further tax or levy or cess, or variation or repeal of such tax or levy or cess give a written notice thereof to the Engineer-in-charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 35: TERMINATION OF CONTRACT ON DEATH OF CONTRACTOR

Without prejudice to any of the rights or remedies under this contract, if the contractor dies, the Engineer-In-Charge on behalf of the WAPCOS shall have the option of terminating the contract without compensation to the contractor.

CLAUSE 36: IF RELATIVE WORKING IN WAPCOS THEN THE CONTRACTOR NOT ALLOWED TO TENDER

The contractor shall not be permitted to tender for works in the WAPCOS responsible for award and execution of contracts in which his near relative is posted in WAPCOS. He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any Officer in the WAPCOS. Any breach of this condition by the contractor would render him liable to be debarred from tendering in WAPCOS any breach of this condition.

NOTE: By the term "near relatives" is meant wife, husband, parents and grandparents, children and grandchildren, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

CLAUSE 37: NO GAZETTED ENGINEER TO WORK AS CONTRACTOR WITHIN ONE YEAR OF RETIREMENT

No engineer of gazetted rank or other gazetted officer employed in engineering or administrative duties in an engineering department of the Government of India shall work as a contractor or employee of a contractor for a period of one year after his retirement from government service without the previous permission of Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be such a person who had not obtained the permission of Government of India as aforesaid, before submission of the tender or engagement in the contractor's service, as the case may be.

CLAUSE 38: THEORETICAL CONSUMPTION OF MATERIAL ---------- NOT APPLICABLE

(i) After completion of the work and also at any intermediate stage in the event of non-reconciliation of materials issued, consumed and in balance - (see Clause 10), theoretical quantity of materials issued by the WAPCOS for use in the work shall be calculated on the basis and method given hereunder:-

(a) Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in Special Conditions of Contract. In case any item is executed for which standard constants for the consumption of cement or bitumen are not available in the above mentioned schedule/statement or cannot be derived from the same shall be calculated on the basis of standard formula to be laid down by the Engineer-in-Charge.

(b) Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Engineer-in-Charge, including authorized lappages, chairs etc. plus 3% wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual issues each diameter wise, section wise and category wise separately.

(c) Theoretical quantity of G.I. & C.I. or other pipes, conduits, wires and cables, pig lead and G.I./M.S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G.I./M.S. sheets it shall be 10%), such determination & comparison being made diameter wise & category wise.

(d) For any other material as per actual requirements.

Over the theoretical quantities of materials so computed a variation shall be allowed as specified in Special Conditions of Contract. The difference in the net quantities of material actually issued to the contractor and the theoretical quantities including such authorized variation, if not returned by the contractor or if not fully reconciled to the satisfaction of the Engineer-in-Charge within fifteen days of the issue of written notice by the Engineer-in-charge.

(ii) The said action under this clause is without prejudice to the right of the WAPCOS to take action against the contractor under any other conditions of contract for not doing the work according to the prescribed specifications.

CLAUSE 39: COMPENSATION DURING WARLIKE SITUATION ---------NOT APPLICABLE

The work (whether fully constructed or not) and all materials, machines, tools and plants, scaffolding, temporary buildings and other things connected therewith shall be at the risk of the contractor until the work has been delivered to the Engineer-in-Charge and a certificate from him to that effect obtained. In the event of the work or any materials properly brought to the site for incorporation in the work being damaged or destroyed in consequence of hostilities or warlike operation, the contractor shall when ordered (in writing) by the Engineer-in-Charge to remove any debris from the site, collect and properly stack or remove in store all serviceable materials salvaged from the damaged work and shall be paid at the contract rates in accordance with the provision of this agreement for the work of clearing the site of debris, stacking or removal of serviceable material and for reconstruction of all works ordered by the Engineer-in-Charge, such payments being in addition to compensation up to the value of the work originally executed before being damaged or destroyed and not paid for. In case of works damaged or destroyed but not already measured and paid for, the compensation shall be assessed by the Engineer-In-Charge up to Rs. 5,000/- and by the WAPCOS for a higher amount. The contractor shall be paid for the damages/destruction suffered and for restoring the material at the rate based on analysis of rates tendered for in accordance with the provision of the contract. The certificate of the Engineer-in-Charge regarding the quality and quantity of materials and the purpose for which they were collected shall be final and binding on all parties to this contract.

Provided always that no compensation shall be payable for any loss in consequence of hostilities or warlike operations (a) unless the contractor had taken all such precautions against air raid as are deemed necessary by the A.R.P. Officers or the Engineer-in-Charge (b) for any material etc. not on the site of the work or for any tools, plant, machinery, scaffolding, temporary building and other things not intended for the work. In the event of the contractor having to carry out reconstruction as aforesaid, he shall be allowed such extension of time for its completion as is considered reasonable by the Engineer-In-Charge.

CLAUSE 40: APPRENTICES ACT PROVISIONS TO BE COMPLIED WITH

The contractor shall comply with the provisions of the Apprentices Act, 1961 and the rules and orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the contract and the WAPCOS may, in his discretion, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

CLAUSE 41: RELEASE OF SECURITY DEPOSIT AFTER LABOUR CLEARANCE

Release of Security Deposit of the work shall not be refunded till the contractor produces a clearance deposit after labour certificate from the Labour Officer. As soon as the work is virtually complete the contractor shall apply for the clearance certificate to the Labour Officer under intimation to the Engineer-in-Charge. The Engineer-in-Charge, on receipt of the said communication, shall write to the Labour Officer to intimate if any complaint is pending against the contractor in respect of the work. If no complaint is pending, on record till after 3 months after completion of the work and/or no communication is received from the Labour Officer to this effect till six months after the date of completion, it will be deemed to have received the clearance certificate and the Security Deposit will be released if otherwise due.

CLAUSE42: INSURANCE

1. Requirements

Before commencing execution of works, unless stated otherwise in the special conditions of contract, it shall be obligatory for the contractor to obtain at his own cost stipulated insurance cover under the following requirements:

a) Contractor's all risk and Third Party Cover.
b) Liability under the workmen's compensation Act, 1923, Minimum Wages Act, 1948 and Contract Labour (Regulation and Abolition) Act, 1970.
c) Accidents to staff, Engineers, Supervisors and others who are not governed by workmen's compensation Act.
d) Damage to material, machinery and works due to fire theft etc.
e) Any other risk to be covered by insurance as may be specified by the employer in the special conditions of contract.

2. Policy in Joint Names of Contractor and Employer

The policy referred to under sub-clause 46(1) above shall be obtained in the joint names of the contractor and the employer and shall inter-alia provide coverage against the following, arising out of or in connection with execution of works, their maintenance and performance of the contract.

a) Loss of life or injury involving public, employee of the contractor, or that of employer and Engineer, labour etc.
b) Injury, loss or damage to the works or property belonging to public, government bodies, local authorities, utility organizations, contractors, employer or others.

3. Currency of Policy

The policies shall remain in force throughout the period of execution of the works and till the expiry of the defect liability period. The contractor shall, whenever called upon, produce to the engineer or his representative the various insurance policies obtained by him as also the rates of premium and the premium paid by him to ensure that the polices indeed continue to be in force. If the contractor fails to effect or keep in force or provide adequate cover in the insurance policies mentioned in the sub clause 46(1) or any other insurance he might be required to effect under the contract, then in such cases, the employer may effect and keep in force any such insurance or further insurance and the cost and expenses incurred by him in this regard shall be deductible from payments due to the contractor or from the contractor's performance security.

CLAUSE 43: CONDITIONS SPECIFIC TO GREEN BUILDINGS PRACTICES CLAUSE

The contractor shall strictly adhere to the following conditions as part of his contractual obligations:

1. SITE

1.1 The contractor shall ensure that adequate measures are taken for the prevention of erosion of the top soil during the construction phase. The contractor shall implement the Erosion and Sedimentation Control Plan (ESCP) provided to him by the Engineer-in-charge as part of the larger Construction Management Plan (CMP). The contractor shall obtain the Erosion and

Sedimentation Control Plan (ESCP) Guidelines from the Engineer-in-charge and then prepare "working plan" for the following month's activities as a CAD drawing showing the construction management, staging & ESCP. At no time soil should be allowed to erode away from the site and sediments should be trapped where necessary.

1.2 The contractor shall ensure that all the top soil excavated during construction works is neatly stacked and is not mixed with other excavated earth. The contractors shall take the clearance of the architects / Engineer-in-charge before any excavation. Top soil should be stripped to a depth of 20 cm (centimetres) from the areas to be disturbed, for example proposed area for buildings, roads, paved areas, external services and area required for construction activities etc. It shall be stockpiled to a maximum height of 40 cm in designated areas, covered or stabilized with temporary seeding for erosion prevention and shall be reapplied to site during plantation of the proposed vegetation. Top soil shall be separated from subsoil, debris and stones larger than 50 mm (millimetre) diameter. The stored top soil may be used as finished grade for planting areas.

1.3 The contractor shall carry out the recommendations of the soil test report for improving the soil under the guidance of the Engineer-in-charge who would also advise on the timing of application of fertilizers and warn about excessive nutrient levels.

1.4 The contactor shall carry out post-construction placement of topsoil or other suitable plant material over disturbed lands to provide suitable soil medium for vegetative growth. Prior to spreading the topsoil, the sub-grade shall be loosened to a depth of 50mm to permit bonding. Topsoil shall be spread uniformly at a minimum compacted depth of 50mm on grade 1:3 or steeper slopes, a minimum depth of 100mm on shallower slopes. A depth of 300mm is preferred on relatively flatter land.

1.5 The Contractor should follow the construction plan as proposed by the Engineer-in-charge to minimize the site disturbance such as soil pollution due to spilling. Use staging and spill prevention and control plan to restrict the spilling of the contaminating material on site. Protect top soil from erosion by collection storage and reapplication of top soil, constructing sediment basin, contour trenching, mulching etc.

1.6 No excavated earth shall be removed from the campus unless suggested otherwise by Engineer-in-charge. All subsoil shall be reused in backfilling/landscape, etc as per the instructions of the Engineer-in-charge

1.7 The contractor shall not change the natural gradient of the ground unless specifically instructed by the architects / landscape consultant. This shall cover all natural features like water bodies, drainage gullies, slopes, mounds, depressions, rocky outcrops, etc. Existing drainage patterns through or into any preservation area shall not be modified unless specifically directed by the Engineer-in-charge.

1.8 The contractor shall not carry out any work which results in the blockage of natural drainage.

1.9 The contractor shall ensure that existing grades of soil shall be maintained around existing vegetation and lowering or raising the levels around the vegetation is not allowed unless specifically directed by the Engineer-in-charge

1.10 Contractor shall reduce pollution and land development impacts from automobiles use during construction.

1.11 Overloading of trucks is unlawful and creates and erosion and sedimentation problems, especially when loose materials like stone dust, excavated earth, sand etc. are moved. Proper covering must take place. No overloading shall be permitted.

2. CONSTRUCTION PHASE AND WORKER FACILITIES

2.1 The contractor shall specify and limit construction activity in preplanned/ designated areas and shall start construction work after securing the approval for the same from the Engineer-in-charge. This shall include areas of construction, storage of materials, and material and personnel movement.

2.2 Preserve and Protect Landscape during Construction

a) The contractor shall ensure that no trees, existing or otherwise, shall be harmed and damage to roots should be prevented during trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the tree, or, from a safe distance from the tree/plant by means of barricading. Trees will not be used for support; their trunks shall not be damaged by cutting and carving or by nailing posters, advertisements or other material. Lighting of fires or carrying out heat or gas emitting construction activity within the ground, covered by canopy of the tree is not to be permitted.

b) The contractor shall take steps to protect trees or saplings identified for preservation within the construction site using tree guards of approved specification.

c) The contractor shall conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity. Contractor should limit all construction activity within the specified area as per the Construction Management Plan (CMP) proposed by the Engineer-in-charge. All the existing trees should be preserved, if not possible than compensate the loss by re-planting trees in the proportion of 1:3.

d) The contractor shall avoid cut and fill in the root zones, through delineating and fencing the drip line (the spread limit of a canopy projected on the ground) of all the trees or group of trees. Separate the zones of movement of heavy equipment, parking, or excessive foot traffic from the fenced plant protection zones.

e) The contractor shall ensure that maintenance activities shall be performed as needed to ensure that the vegetation remains healthy. The preserved vegetated area shall be inspected by the Engineer-in-charge at regular intervals so that they remain undisturbed. The date of inspection, type of maintenance or restorative action followed shall be recorded in the logbook.

2.3 Contractor shall be required to develop and implement a waste management plan, quantifying material diversion goals. He shall establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals. A project-vide policy of “Nothing leaves the Site” should be followed. In such a case when strictly followed, care would automatically be taken in ordering and timing of materials such that excess doesn’t become “waste”. The Contractor’s ingenuity is especially called towards meeting this prerequisite/ credit (GRIHA). Consider recycling cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area(s) on the construction site for segregated or commingled collection of recyclable material, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

2.4 Contractor shall collect all construction waste generated on site. Segregate these wastes based on their utility and examine means of sending such waste to manufacturing units

Which use them as raw material or other site which require it for specific purpose. Typical construction debris could be broken bricks, steel bars, broken tiles, spilled concrete and mortar etc.

2.5 The contractor shall provide clean drinking water for all workers

2.6 The contractor shall provide the minimum level of sanitation and safety facilities for the workers at site. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water and latrines and urinals as per applicable standard. Adequate toilet facilities shall be provided for the workman within easy access of their place of work. The total no. to be provided shall not be less than 1 per 30 employs in any one shift. Toilet facilities shall be provided from the start of building operations, connection to a sewer shall be made as soon as practicable. Every toilet shall be so constructed that the occupant is sheltered from view and protected from the weather and falling objects. Toilet facilities shall be maintained in a sanitary condition. A sufficient quantity of disinfectant shall be provided. Natural or artificial illumination shall be provided.

2.7 The contractor shall ensure that air pollution due to dust/generators is kept to a minimum, preventing any adverse effects on the workers and other people in and around the site. The contractor shall ensure proper screening, covering stockpiles, covering brick and loads of dusty materials, wheel-washing facility, gravel pit, and water spraying. Contractor shall ensure the following activities to prevent air pollution during construction:

- Clear vegetation only from areas where work will start right away
- Vegetate / mulch areas where vehicles do not ply.
- Apply gravel / landscaping rock to the areas where mulching / paving is impractical
- Identify roads on-site that would be used for vehicular traffic. Upgrade vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape and mineral types that make up the surface & base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles (smaller than 0.075mm) to 10 – 20%
- Water spray, through a simple hose for small projects, to keep dust under control. Fine mists should be used to control fine particulate. However, this should be done with care so as not to waste water. Heavy watering can also create mud, which when tracked onto paved public roadways, must be promptly removed. Also, there must be an adequate supply of clean water nearby to ensure that spray nozzles don't get plugged. Water spraying can be done on:
    a) Any dusty materials before transferring, loading and unloading
    b) Area where demolition work is being carried out
    c) Any un-paved main haul road
    d) Areas where excavation or earth moving activities are to be carried out
- The contractor shall ensure that the speed of vehicles within the site is limited to 10 km/hr.
- All material storages should be adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust / particulate emissions.

- Spills of dirt or dusty materials will be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean-up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained / cleaned up immediately before they can infiltrate into the soil / ground or runoff in nearby areas
- Provide hoardings of not less than 3m high along the site boundary, next to a road or other public area
- Provide dust screens, sheeting or netting to scaffold along the perimeter of the building Cover stockpiles of dusty material with impervious sheeting
- Cover dusty load on vehicles by impervious sheeting before they leave the site

2.8 Contractor shall be required to provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals. He shall coordinate the size and functionality of the recycling areas with the anticipated collections services for glass, plastic, office paper, newspaper, cardboard, and organic wastes to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminum can crushers, recycling chutes, and collection bins at individual workstations to further enhance the recycling program.

2.9 The contractor shall ensure that no construction leach ate (Ex: cement slurry), is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including, reduction of wasteful curing processes, collection, basic filtering and reuse. The contractor shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to the treatment device or facility (municipal sewer line).

2.10 Staging (dividing a construction area into two or more areas to minimize the area of soil that will be exposed at any given time) should be done to separate undisturbed land from land disturbed by construction activity and material storage.

2.11 The contractor shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 _Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site to render and direct first-aid to causalities. A telephone may be provided to first-aid assistant with telephone numbers of the hospitals displayed. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities.

2.12 The contractor shall ensure the following activities for construction workers safety, among other measures:

- Guarding all parts of dangerous machinery.
- Precautionary signs for working on machinery
- Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition.

- Durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.
- Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.
- Provide protective equipment; helmets etc.
- Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area and elsewhere.
- Provide sufficient and suitable light for working during night time.

2.13 Adopt additional best practices, prescribed norms in construction industry.

2.14 The storage of material shall be as per standard good practices as specified in Part 7, Section 2 – Storage, Stacking and Handling practices, NBC 2005 and shall be to the satisfaction of the Engineer-in-charge to ensure minimum wastage and to prevent any misuse, damage, inconvenience or accident. Watch and ward of the Contractor's materials shall be his own responsibility. There should be a proper planning of the layout for stacking and storage of different materials, components and equipment's with proper access and proper maneuverability of the vehicles carrying the materials. While planning the layout, the requirements of various materials, components and equipment's at different stages of construction shall be considered. The Owner shall not take any responsibility on any account.

2.15 The contractor shall provide for adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The contractor shall ensure that the site and the workers facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labelled in both Hindi and English.

2.16 The contractor shall prepare and submit 'Spill prevention and control plans' before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.

2.17 Contractor shall collect the relevant material certificates for materials with high recycled (both post-industrial and post-consumer) content, including materials for structural use like TMT steel rolled with high percentage of recycled steel, and RMC mix with fly-ash etc. (see appendix)

2.18 Contractor shall collect the relevant material certificates for rapidly renewable materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheat board, strawboard and cork.

2.19 Contractor shall adopt an IAQ (Indoor Air Quality) management plan to protect the system during construction, control pollutant sources, and interrupt pathways for contamination. He shall sequence installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile, and gypsum wallboard. He shall also protect stored on-site or installed absorptive materials from moisture damage.

2.20 The contractor shall ensure that a flush out of all internal spaces is conducted prior to Andover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.

2.21 Contractor shall make efforts to reduce the quantity of indoor air contaminants that are dorous or potentially irritating harmful to the comfort and well-being of installer and building occupants. Contractor shall ensure that the VOC (Volatile Organic Compounds) content of paints, coatings and primers used must not exceed the VOC content limits mentioned below:
Paints
Non-flat - 150 g/L
Flat (Mat) - 50 g/L
Anti-corrosive/ anti rust - 250 g/L
Coatings
Clear wood finishes
Varnish - 350 g/L
Lacquer - 550 g/L
Floor coatings - 100 g/L
Stains - 250 g/L
Sealers
Waterproofing sealer - 250 g/L
sanding sealer - 275 g/L
Other sealers - 200 g/L
The VOC (Volatile Organic Compounds) content of adhesives and sealants used must be less than VOC content limits mentioned:

Architectural Applications VOC Limit (g/l less water)
Indoor Carpet adhesives - 50
Carpet Pad Adhesives - 50
Wood Flooring Adhesive - 100
Rubber Floor Adhesives - 60
Sub Floor Adhesives - 50
Ceramic Tile Adhesives - 65
VCT and Asphalt Tile adhesives - 50
Dry Wall and Panel Adhesives - 50
Structural Glazing Adhesives - 100
Multipurpose Construction Adhesives - 70
Substrate Specific Application VOC Limit (g/l less water)
Metal to Metal - 30
Plastic Foams - 50
Porous material (except wood) - 50
Wood - 30
Fiber Glass – 80

2.22 Wherever required, Contractor shall meet and carry out documentation of all activities on site, supplementation of information, and submittals in accordance with GRIHA program standards and guidelines. Towards meeting the aforementioned building environmental rating standard(s) expert assistance shall be provided to him up on request.

2.23 WATER USE DURING CONSTRUCTION

Contractor should spray curing water on concrete structure and shall not allow free flow of water. After liberal curing on the first day, all the verticals surfaces of concrete structures should be painted with curing chemical to save water nothing extra shall be paid. Concrete

structures should be kept covered with thick cloth/gunny bags and water should be sprayed on them. Contractor shall do water ponding on all sunken slabs using cement and sand mortar.

2.24 The Contractor shall remove from site all rubbish and debris generated by the Works and keep Works clean and tidy throughout the Contract Period. All the serviceable and non-service able (malba) material shall be segregated and stored separately. The malba obtained during construction shall be collected in well-formed heaps at properly selected places, keeping in a view safe condition for workmen in the area. Materials which are likely to cause dust nuisance or undue environmental pollution in any other way, shall be removed from the site at the earliest and till then they shall be suitable covered. Glass & steel should be dumped or buried separately to prevent injury. The work of removal of debris should be carried out during day. In case of poor visibility artificial light may be provided.

2.25 MATERIALS & FIXTURES FOR THE PROJECT

2.26 The contractor shall endeavour to source most of the materials for construction at this project within a distance of 800 km radius from the project site. Contractor shall collect the relevant material certificates to prove the same

h) Any material that is to be sourced from outside the prescribed radius shall be done after securing the necessary approval from the Engineer-in-charge.

i) All cement used at site for reinforced concrete, precast members, mortar, plaster, building blocks, etc shall be PPC (Ordinary Portland Cement). The PPC must meet the requirements of IS 1489: 1991. (Minimum 25% replacement of cement with fly ash in PPC (Portland Pozzolona Cement) by weight of the cement used in the overall RC for meeting the equivalent strength requirements).

j) As a measure to reduce wastage and water consumption during construction, the contractor shall source or set up the infrastructure for a small scale ready mix concrete, all concreting works at site shall utilize only batch mix concrete.

k) The contractor has to comply as per MoEF issued notification 8.0.763(E) dated 14th Sept.1999 containing directive for greater fly ash utilization, where it stipulates that ii. Every construction agency engaged in the construction of buildings within a radius of 50 km radius of a Thermal Power Plant, have to use of 100% fly ash based bricks/blocks in their construction. Any brick/block containing more than 25% fly ash is designated as fly ash brick/block. As per GRIHA credits, bricks / blocks should contain more than 40% fly ash.

l) The contractor shall ensure that sand from approved source is used in place of sand in an all concreting works unless specifically instructed otherwise by the Engineer-in-charge.

m) Timber and aluminum use should be minimized in the project. If used, timber shall constitute of reclaimed timber and aluminum shall constitute recycled content. The source of such reclaimed timber shall be approved by the Engineer-in-charge.

n) The contractor shall ensure that nontoxic anti-termite and other pest control is strictly used.

o) The contractor shall ensure that all paints, polishes, adhesives and sealants used both internally and externally, on any surface, shall be Low VOC products. The contractor shall get prior approval from the Engineer-in-charge before the application of any such material.

p) All plumbing and sanitary fixtures installed shall be as per the requirement of the GRIHA and shall adhere to the minimum LPM and LPF mentioned.

q) The contractor shall employ 100% zero ODP (ozone depletion potential) insulation; HCFC hydro-chlorofluorocarbon)/ and CFC (chlorofluorocarbon) free HVAC and refrigeration equipment's and/halon-free fire suppression and fire extinguishing systems.

r) The contractor shall ensure that all composite wood products/agro-fiber products used for cabinet work, etc do not contain any added urea formaldehyde resin.

2.28 CONSTRUCTION WASTE

a) Contractor shall ensure that wastage of construction material is kept to a maximum of 3%.

b) All construction debris generated during construction shall be carefully segregated and stored in a demarcated waste yard. Clear, identifiable areas shall be provided for each waste type. Employ measures to segregate the waste on site into inert, chemical, or hazardous wastes.

c) All construction debris shall be used for road preparation, back filling, etc, as per the instructions of the Engineer-in-charge, with necessary activities of sorting, crushing, etc.

d) No construction debris shall be taken away from the site, without the prior approval of the Engineer-in-charge.

e) The contractor shall recycle the unused chemical/hazardous wastes such as oil, paint, batteries, and asbestos

f) If and when construction debris is taken out of the site, after prior permissions from the Project Manager, then the contractor shall ensure the safe disposal of all wastes and will only dispose of any such construction waste in approved dumping sites.

g) Inert waste to be disposed off by Municipal Corporation/ local bodies at landfill sites.

2.29 Documentation

a) The contractor shall, during the entire tenure of the construction phase, submit the following records to the Engineer-in-charge on a monthly basis:
   i) Water consumption in litres
   ii) Electricity consumption in 'kwh' units
   iii) Diesel consumption in litres
   iv) Quantum of waste generated at site and the segregated waste types divided into inert, chemical and hazardous wastes.
   v) Digital photo documentation to demonstrate compliance of safety guidelines as specified here.

b) The contractor shall, during the entire tenure of the construction phase, submit the following records to the Engineer-in-charge on a weekly basis:
   i) Quantities of material brought into the site, including the material issued to the contractor.
   ii) Quantities of construction debris (if at all) taken out of the site
   iii) Digital photographs of the works at site, the workers facilities, the waste and other material storage yards, pre-fabrication and block making works, etc. as guided by the Engineer-in-charge.

c) The contractor shall submit one document after construction of the buildings, a brief description along with photographic records to show that other areas have not been disrupted during construction. The document should also include brief explanation and photographic records to show erosion and sedimentation control measures adopted. (Document CAD drawing showing site plan details of existing vegetation, existing buildings, existing slopes and site drainage pattern, staging and spill prevention measures, erosion and sedimentation control measures and measures adopted for top soil preservation during construction

d) The contractor shall submit to the Engineer-in-charge after construction of the buildings, a detailed as built quantification of the following:
   i) Total materials used,
   ii) Total top soil stacked and total reused
   iii) Total earth excavated,
   iv) Total waste generated,
   v) Total waste reused,
   vi) Total water used,
   vii) Total electricity, and
   viii) Total diesel consumed.

e) The contractor shall submit to the Engineer-in-charge, before the start of construction, a site plan along with a narrative to demarcate areas on site from which top soil has to be gathered, designate area where it will be stored, measures adopted for top soil preservation and indicate areas where it will be reapplied after construction is complete.

f) The contractor shall submit to the Engineer-in-charge, a detailed narrative (not more than 250 words) on provision for safe drinking water and sanitation facility for construction workers and site personnel.

g) Provide supporting document from the manufacturer of the cement specifying the fly-ash content in PPC used in reinforced concrete.

h) Provide supporting document from the manufacturer of the pre-cast building blocks specifying the fly ash content of the blocks used in an infill wall system.

i) The contractor shall, at the end of construction of the buildings, submit to the Engineer-in-charge, submit following information, for all material brought to site for construction purposes, including manufacturer's certifications, verifying information, and test data, where Specifications sections require data relating to environmental issues including but not limited to:

   Source of products: Supplier details and location of the supplier and brand name.

   ii) Project Recyclability: Submit information to assist Owner and WAPCOS in recycling materials involved in shipping, handling, and delivery, and for temporary materials necessary for installation of products.

   iii) Recycled Content: Submit information regarding product postindustrial recycled and post-consumer recycled content. Use the "Recycled Content Certification Form", to be provided by the Commissioning Authority appointed for the Project.

   iv) Product Recyclability: Submit information regarding product and product's component's recyclability including potential sources accepting recyclable materials.

   v) Clean tech: Provide pollution clearance certificates from all manufacturers of materials

   vi) Indoor Air quality and Environmental Issues: Submit following certificates:

      a) Certifications from manufacturers of Low VOC paints, adhesives, sealant and polishes used at this particular project site.

      b) Certification from manufacturers of composite wood products/agro fibre products on the absence of added urea formaldehyde resin in the products supplied to them to this particular site.

      c) Submit environmental and pollution clearance certificates for all diesel generators installed as part of this project.

j) Provide total support to the Engineer-in-charge appointed by the WAPCOS in completing all Green Building Rating related formalities, including signing of forms, providing signed letters in the contractor's letterhead.

2.30 EQUIPMENT

a) To ensure energy efficiency during and post construction all pumps, motors and engines used during construction or installed, shall be subject to approval and as per the specifications of the architects.

b) All lighting installed by the contractor around the site and at the labour quarters during construction shall be CFL/LED bulbs of the appropriate illumination levels. This condition is a must, unless specifically prescribed.

The contractor is expected to go through all other conditions of the GRIHA rating stipulations, which can be provided to him by the architects.

Failure to adhere to any of the above mentioned items, without necessary clearances from the architects and the Engineer-in-charge, shall be deemed as a violation of contract and the contractor shall be held liable for penalty as determined by the architects.

CLAUSE 44: PAYMENT

1. Payment Schedule

The Payment Schedule includes a schedule setting out each Milestone Event to be achieved in a month for the Works.

2. Contractor's Application for Payment

From the date of issue of the Notice to Proceed, on the 5th (fifth) Business Day of any month, the Contractor may submit a Request for Payment, to WAPCOS Limited Representative in respect of the preceding month.

Within each Request for Payment the Contractor shall show separately:

(i) The amounts which the Contractor claims to be payable as the cost of the Works completed during that month; and
(ii) The cumulative amount of all prior payments made by WAPCOS Limited; and
(iii) Any amounts to which the Contractor considers are due and payable to it in accordance with the provisions of the Contract.

The Contractor's Request for Payment shall:

(i) Be prepared on forms in the form and in a number advised by WAPCOS Limited Representative; and
(ii) Contain confirmation of the relevant Milestone Events which, in the opinion of the Contractor have been achieved in that month which applies to each such Milestone Event; and
(iii) Be accompanied by:
  (a) Copy of relevant records of measurement of works, jointly taken and signed by both the parties;

(b) A status report describing in such detail as may reasonably request, the percentage of any uncompleted Milestone Event for the month in question and the work to be undertaken by the Contractor prior to the next Request for Payment;
(c) Certification by WAPCOS Limited Representative confirming that the Milestone Events referred to in the Request for Payment have been achieved.
(d) Confirmation by the Contractor of any amounts due and owing from the Contractor to WAPCOS Limited pursuant to the Contract;
(e) The Contractor's certification that the quality of all completed Works accords with the requirements of the Contract;
(f) The Contractor's certification that each obligation, item of cost or expense mentioned in that Request for Payment has not been the basis of any previous payment.
(g) The Contractor's certification that it has reviewed all financial and budget data contained in the Request for Payment;
(h) The Contractor's certification that the quality of all completed Works accords with the requirements of the Contract;
(i) The Contractor's certification that each obligation, item of cost or expense mentioned in that Request for Payment has not been the basis of any previous payment; and
(j) The Contractor's certification that each Subcontractor who performed part of the Works which was included in the immediately preceding Certificates of Payment was paid all amounts then due to it for such Works
(k) The Contractor providing evidence of the validity of the Contractor's Insurances.

3. Certificates of Payment

Within [14 (fourteen)] Business Days of receipt of the Contractor's Request for Payment under Clause 48(2) [Contractor's Application for Payment], WAPCOS Limited and WAPCOS Limited Representative shall review such request and, shall issue to the Contractor, a Certificate of Payment certifying what amounts WAPCOS Limited shall pay. Each Certificate of Payment shall be for an amount which in the opinion of WAPCOS Limited, is the basis of the Request for Payment and pursuant to the Contract, is properly due to the Contractor (the "Gross Certifiable Amount") less (i) the cumulative amounts of payments previously certified as due to the Contractor, (ii) any deduction on account of recovery of Advance Payment, and (iii) Retention Amount.

In the event that the Contractor fails to achieve any Milestone Event specified in the Payment Schedule, the Contractor shall not be entitled to the payment value attributable to that Milestone Event until the relevant Milestone Event has been achieved. When the relevant Milestone Event is achieved, the Contractor may include the payment value attributable to the Milestone Event in the next Request for Payment.

No sum shall be included in the Certificate of Payment in respect of Materials yet to be incorporated into the Permanent Works unless the WAPCOS Limited Representative is satisfied that:

(i) such Materials have been properly acquired and properly and not prematurely delivered to the Project Site;
(ii) such Materials have been properly stored on the Project Site and fully protected against loss, damage or deterioration;
(iii) the Contractor's records of the requisitions, orders, receipts and use of any Materials

are kept in a form approved by the WAPCOS Limited Representative, and such records are available for inspection by the WAPCOS Limited Representative; and

(iv) The Contractor has submitted a proper statement of the cost of acquiring the Materials together with such documents as may be required for evidencing such cost.

Without prejudice to any other rights of WAPCOS Limited to withhold payment to the Contractor, WAPCOS Limited may withhold from any payment due to the Contractor such amount as WAPCOS Limited deems reasonably necessary or appropriate:

(i) if in the opinion of the WAPCOS Limited Representative the progress of the Works at the time of the Request for Payment is behind the progress of the Works as set out in the Program; and/or

(ii) to protect it from any losses, expenses, costs or liability because of any one or more of the following reasons:
   (a) defects and deficiencies in any Works, whether or not payment has beenmade;
   (b) unsatisfactory performance of the Contract;
   (c) the filing of third party claims relating to the Works or any of its commitment parts for which the Contractor is liable;
   (d) the Contractor's failure to make payments to Subcontractors;
   (e) failure by the Contractor to provide or procure replacement Performance Security in accordance with the Contract;
   (f) failure by the Contract to provide evidence of insurance coverage inaccordance with the Contract;
   (g) reasonable evidence that Completion will not occur by the Time for Completion;
   (h) any overpayments made by WAPCOS Limited with respect to a previous payment;
   (i) failure by the Contractor to submit a properly updated monthly Program; and
   (j) failure by the Contractor to provide satisfactory evidence that the costs of all labour and Materials and other obligations arising out of the Contract have been fully satisfied and discharged by the Contractor and/or to otherwise fail to submit adequate supporting documentation for any Request for Payment.

Any Provisional Sum Works shall only be executed in whole or part upon the WAPCOS Limited Representative's instruction. If the WAPCOS Limited Representative issues no such instruction, the Provisional Sum Works shall not form part of the Works and the Contractor shall not be entitled to payment for it. The Contractor shall be deemed to have allowed the necessary time and resources to enable design and Execution of the Provisional Sum Works in so far as the scope and nature of the Provisional Sum Works was reasonably foreseeable.

The Contractor shall be entitled only to such amount in respect of the Provisional Sum Works as the WAPCOS Limited Representative determines in accordance with this Clause 48(3). The WAPCOS Limited Representative shall notify the Contractor of any such determination. The WAPCOS Limited Representative shall have the authority to issue instructions to the Contractor for every Provisional Sum Works for which the Contractor shall be entitled to a part of the Provisional Sum as determined by the WAPCOS Limited Representative.

The Contractor shall produce to the WAPCOS Limited Representative all quotations, vouchers, invoices, accounts or receipts in connection with the expenditure in respect of

the Provisional Sum Works, except where the Provisional Sum Works is valued in accordance with the item wise rates quoted by the Contractor in its bid submitted to the Employer.

In respect of every Provisional Sum the WAPCOS Limited Representative shall have authority to issue instructions for the execution of work or for the supply of goods, materials, Plant Sums or services by the Contractor, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 48(3).

4. Payment

WAPCOS Limited shall pay the amount certified in a Certificate of Payment less the amount paid earlier in accordance with Clause 48 (3) [Certificate of Payment], no later than [21 (twenty one)] Business Days from the date of such Certificate of Payment.

Payment Terms:

The Associate/Sub – Consultant/Sub-Contractor acknowledges that under the present Contract/Agreement/Work Order/Arrangement, WAPCOS is only working as intermediary between Client being Principal Employer/Client and Associate/Sub-consultant/Sub-Contractor. Thus the Associate/Sub-consultant/Sub-Contractor unconditionally acknowledges that the payments under the present contract/Agreement/Work Order/Arrangement shall be made proportionately by WAPCOS only on back to back basis i.e. after 21 days subject to receipt of payment from Client being Principal Employer/Client. The Associate/Sub-consultant/Sub-Contractor also unconditionally agree that in the event the payment or part thereof, under the present Contract/Agreement/Work Order/Arrangement is not received from Client (Principal Employer/Client), then WAPCOS &/or any of its Employee/Officer shall not be responsible to pay any amount to Associate/Sub-consultant/Sub-Contractor. The said condition shall supersede any and all other conditions of Contract/Agreement/Work Order/Arrangement between the parties

Clause-45-Variation

This tender is based upon the estimations on the basis of site conditions (tentative) enclosed with technical specifications and BOQ. WAPCOS Limited reserves the right to vary any individual item to any extent either positive or negative within the scope of work as defined as per the requirement of Client/WAPCOS Limited. The decision as to items are within the scope of work shall be of WAPCOS Limited which is final & binding. Therefore in case of variation in quantity as given in BOQ either positive or negative no rate revision is applicable. In case of New Rate or Price of the Substituted/Extra/deduction items shall be derived from any relevant rates or prices in the Contract. New rate or price of the substituted/Extra/deduction items shall be derived from the Delhi Schedule of Rates -2021 with applicable cost index. In case the rates are not available in DSR, the same shall be derived from the Himachal Pradesh SOR. Further, if not available in that also, competitive market quotes, obtained by WAPCOS Limited/WAPCOS Limited representative. The contractor's profit and overheads together shall be taken as 15% only. ESI, Bonus, CPoH and EPF etc. as applicable also taken in case of changes in the manpower.

1. Contractor shall carry out the extra quantity of work under deviation from the estimated quantity at the rate quoted in the BoQ limited to 25% deviation on each item and for the quantity deviated beyond 25% market rates will be applicable. Execution of such deviation in quantity shall require prior written permission from WAPCOS/Client.
2. Contractor shall submit the detailed work schedule so as to complete the works considering all the field conditions in accordance with the requirement of the engineer-in-charge. Contractor should also strictly adhere to such schedule mutually accepted to complete the total work within the time period mentioned in the contract.
3. The completion cost of any work/special work shall not exceed 1.25 times the tendered amount and 10% of the sanctioned cost for budgeted works. The Engineer-in-charge shall record reasons for such deviation beyond the contract amount and take necessary approval from competent authority

CLAUSE46: BLACKLISTING POLICY

The Blacklisting Policy of the company is available on official website of WAPCOS Limited. The Bidder/tenderer/consultant/contractors have to mandatorily furnish an undertaking addressing the same to Engineer-in-Charge in the form of certificate to abide the contents of Blacklisting Policy as per FORM-C. Any action in violation of the blacklisting policy or to the certificate furnished shall result in cancellation of tender at the stage before or after the award of work.

SECTION– IV

SPECIAL CONDITIONS OF CONTRACT

SECTION–IV

SPECIAL CONDITIONS OF CONTRACT

1.0 SPECIAL CONDITIONS OF CONTRACT

The Special Condition of Contract (SCC) shall be followed by the Contractor in addition to the General Condition of Contract (GCC) of tender document. The following General Condition of Contract of this tender are modified/added as detailed below. In case of any discrepancy between GCC and SCC, the SCC will succeed over GCC.

Clause No.	Description	Applicability/Modified/ Added
GENERAL RULES AND DIRECTIONS		
19	List of works from	Not Applicable
DEFINITIONS		
Added	Principal Employer/ Owner/Client means Department of Youth Service and Sports, Himachal Pradesh	
2(iii)	Work / Project Means: **As Mentioned in NIT**	
2(iv)	Site / Location Means **As Mentioned in NIT**	
2 (vi & vii)	Engineer-In-Charge & Accepting Authority Will be intimated to the successful Bidder at the time of issue of Notice to Proceed the works.	
2 (x)	Market Rate Percentage on cost of materials and labour to cover all overheads and profits	15%
2(xi)	Standard Schedule of Rates for works	Work will be executed as per the provisions of Delhi Schedule of Rates-2021 /State Schedule of Rates of Himachal Pradesh with applicable cost index
2(xvi)	Date of Commencement of work	7 days after date of award of Work (LOI)
CLAUSES OF CONTRACT		
Clause 1	Performance Guarantee a) Performance Guarantee. b) Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance. c) Validity of Performance Guarantee	**Applicable** 3% of Tendered Value 15 days The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that

Clause No.	Description	Applicability/Modified/ Added
	d) Release of Performance Guarantee	Performance guarantee shall be returned to the contractor, without any interest after Completion & successful handing over of the project and issuance of Completion Certificate by WAPCOS.
Clause 1A	Security Deposit	Applicable 2.5% of Tendered Value/Actual value
	Release of security Deposit	Successful Completion of Defect Liability period without any interest.
Clause 2	Compensation for Delay	Applicable 0.50% of the awarded cost of work per week. (Maximum up to 10% of the actual cost of work which includes awarded cost of work, cost of extra items/ substituted items and cost of deviation, if any.)
Clause 2A	Incentive for Early Completion	Not Applicable
Clause 5	Time and Extension for Delay	Applicable
	Number of days from the date of issue of letter of acceptance for reckoning date of start	5 days
	Stipulated time of completion of project	As Mentioned in NIT
Clause 7	Payment on Intermediate Certificate to be Regarded as advance	Not Applicable
New Clause 7A (Added)	Payment	The Bidder (Contractor) acknowledges that under the present Tender and Work Order/ Contract Agreement (if work is awarded to bidder), WAPCOS is working as implementing agency on behalf of Department of Youth Service and Sports, Himachal Pradesh being Principal Employer. Thus the bidder unconditionally acknowledges that the payments under the present Tender and Work Order/ Contract Agreement (if work is awarded to bidder) shall be made proportionately by WAPCOS only on back to back basis i.e., after 45 days subject to receipt of payment from YSS. The Bidder also unconditionally agree that in the event the, payment or part thereof, under the present Tender and Work Order/ Contract Agreement (if work is awarded to bidder) is not received from Youth Service and Sports Department, Himachal

Clause No.	Description	Applicability/Modified/ Added
		Pradesh, then WAPCOS &/or any of its Employee/ Officer shall not be responsible to pay any amount to Bidder. The said condition shall supersede any and all other conditions of Tender and Work Order/ Contract Agreement between the parties (if work is awarded to bidder). All payments shall be released by way of e-transfer through RTGS in India directly at their Bank account by WAPCOS The projects are belongs to the Government of India. The procedure of payment of RA bills will be as follows: 1) Contractor shall submit RA bills duly certified and signed by Site Project Manager/ Engineer, WAPCOS. 2) Site Project Manager/ Engineer, WAPCOS shall forward bill to Client and same also will be verified by them. 3) Site Project Manager/ Engineer, WAPCOS will forward verified bill to Engineer-in Charge, WAPCOS HQ which will be again checked and verified at HQ and will be processed for payment through finance wing of WAPCOS. 4) The payment to Contractor shall be released after receiving payment from Client. 5) The entire process may take requisite time, however efforts shall made to fast track billing process. 6) However, any delay on account of above procedure should not affect the progress of work at site and if such instances are observed, necessary amount shall be withheld and shall be paid only after necessary Certificate is received from Project Manager/ Engineer, WAPCOS that work is in progress according to the timeline.

		Therefore, while submitting the financial bid, Bidders are advised to consider above facts and also examine fund availability and bear such expenditure to achieve the agreed progress and timeline. No claim and delay in progress will be entertained on account of above facts
Clause 10	Materials Supplied by WAPCOS	Not Applicable
Clause 10A	Materials to be Provided by Contractor List of Testing Equipment to be provided by the Contractor at site lab 1. Cube Testing Machine along with sufficient numbers of cube moulds 2. Set of Sieves for testing of Coarse & fine aggregate along with shaker 3. Slump Cone 4. Vernier Calliper, Screw Gauge, Wire gauge 5. Weighing Balance with weights 6. Rebound Hammer 7. For testing of Design Mix Concrete at site, necessary testing equipment and facility (as per BIS) shall be made available by Contractor as and when required by Engineer-In-Charge or his authorized representative and nothing extra shall be paid on account of this. (Note: The listed equipment / instruments will be installed at his own cost by Contractor in laboratory room which to be constructed by the Contractor at his own cost).	Applicable

Clause No.	Description	Applicability/Modified/ Added
Clause 10 B(i)	Secured Advance on Non-Perishable Materials	Applicable 75% of the assessed value of any material Recovery of Secured Advance: Recovery shall be made by the deduction from the contractors bills commencing after first 10% of the gross value of the work is executed and paid, on pro-rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time 80% of the gross value of the contract is executed and paid.
Clause 10 B(ii)	Mobilization Advance	Applicable 10% of the tendered value on submission of Bank Guarantee Bond from Scheduled Bank for the amount equal to 110% of the amount of advance and valid for the contract period. The mobilization advance bear simple interest at the rate of 10 per cent per annum and shall be calculated from the date of payment to the date of recovery. (It will be provided to the contractor if the same is provided by Youth Service and Sports Department, Himachal Pradesh to WAPCOS) Note: Above 10% Mobilization Advance shall be paid into instalments. The first instalment of 5% of tendered value shall be paid on commencement of the work at site. The second instalment of 5% of tendered value shall be paid after achieving the financial progress of 10 (ten) percent of the contract price.
Clause 10 B(iii)	Plant Machinery & Shuttering Material Advance	Not Applicable
Clause 10 B(iv)	Recovery of Mobilization advance	Applicable Added - 14.75% interest per annum for the period in case of non-return of mobilization advance after stipulated due date.
Clause 10 C	Payment on Account of Increase in Price / Wages due to Statutory Order	Not Applicable
Clause 10 CA	Payment due to Variation in Prices of Materials after Receipt of Tender	Not Applicable

Clause 10 CC	Payment due to Increase / Decrease in Prices / Wages (Excluding Materials covered under Clause 10 CA) after Receipt of Tender for Works	Not Applicable
Clause 11	Works to be Executed in Accordance with Specifications, Drawings, Orders Etc. Specifications to be followed for execution of work	Applicable The following is added: All works are to be executed in accordance with the specifications, all drawings, details of items etc. given with this tender document and vetted design/drawing by WAPCOS & duly approved by IIT/NIT. In case specification of any item is not clear, CPWD Specifications 2009 Vol. I to II with upto date correction slips issued on the last date of submission of tender for Civil work is applicable.
Clause 12	Deviations / Variations Extent and Pricing	
	Clause 12.1	Not applicable

Clause No.	Description	Applicability/Modified/ Added
	Clause 12.2(a)	• Modified as "In the case of extra item(s) (items that are completely new and non-scheduled item in accordance with DSR 2021 (for the place of construction site) /HPSOR 2020 as on date of publishment of this tender), the contractor shall submit proper analysis on the basis of the market rates and as per the provision in DSR 2021(for the place of construction site)/ HPSOR 2020 as on date of publishment of this tender and shall be paid in accordance with rate approved by WAPCOS. • In case the extra item being the Scheduled Item in accordance with DSR 2021(for the place of construction site)/HPSOR 2020 as on date of publishment of this tender, these shall be paid as per the provision in DSR 2023(for the place of construction site)/HPSOR 2020 as on date of publishment of this tender and as approved by WAPCOS. The final rate achieved in this case will be increased or decreased on same percentage as per the percentage of total cost quoted above or below by Contractor in respect of NIT cost, during tendering process.
	Clause 12.2(b)	Modified as "The specification mentioned in Tender may be substituted as per the requirement of Owner/ WAPCOS. • In this case of substituted item(s) (scheduled item in accordance with DSR 2023(for the place of construction site)/HPSOR 2020 as on date of publishment of this tender), these shall be paid as per the provision in DSR 2021/HPSOR 2020 as on date of publishment of this tender and as approved by WAPCOS. The final rate achieved in this case will be increased or decreased on same percentage as per the percentage of total cost quoted above or below by Contractor in respect of NIT cost,

		during tendering process.
Clause No.	**Description**	**Applicability/Modified/ Added**
		• In this case of substituted item(s) (that are completely new and non-scheduled item in accordance with DSR 2023 (for the place of construction site)/HPSOR 2020 as on date of publishment of this tender), the contractor shall submit proper analysis on the basis of the market rates and as per the provision in DSR 2021/HPSOR 2020 as on date of publishment of this tender and shall be paid in accordance with rate approved by WAPCOS. • The rate of tendered item to be substituted will also be assessed by same above manner. • The plus/minus difference of rates of mutually substituted items will be submitted by Contractor and approved by WAPCOS. Accordingly the plus/minus difference of payment will be made to the Contractor for the substituted quantities. • Cost index will be applicable over DSR-2021

Clause No.	Description	Applicability/Modified/ Added
	Clause 12.2,12.3 and 12.4, 12.5	Applicable
Clause 15A	Compensation in case delay supply of material	Not Applicable
Clause 17	Contractor liable for Damages, Defects during Defect Liability Period **Defect Liability Period**	Applicable Added/Modified: ***One (1) years from the date of successful completion of each component of the project and handing over to WAPCOS with all satisfaction & acceptance along with submission of all the required documents i.e. As- built drawings (minimum 5 sets), Inventory list, guarantee / warranty bonds, certificates & invoices of equipment, lock and key of each room and NoCs form various Departments .***
Clause 19L	**Contribution of EPF and ESI**	**NOT APPLICABLE**
Clause 25	Settlement of Disputes and Arbitration	**Modified as:** Any dispute, controversy or claims arising out of or relating to this Contract Agreement (Agreement that will be signed between WAPCOS and Bidder, if work is awarded to bidder), or the breach termination or invalidity thereof shall be settled through following mechanism: a) Firstly, the aggrieved party shall write a letter to the other party detailing its grievances and calling upon the other party to amicably resolve the dispute by convening a joint meeting. Accordingly, the parties as per their convenience shall jointly convene the said meeting(s), wherein minutes of the said meeting(s) shall be prepared and countersigned by all the parties it is mandatory to prepare minutes of meeting(s) and to be countersigned by

Clause No.	Description	Applicability/Modified/ Added
		all the parties, irrespective of the outcome of the said meeting(s). b) In the event the parties are unable to reach on any settlement in the said meeting(s), then the aggrieved party shall mandatory resort to pre-litigation mediation mechanism with Delhi High Court Mediation Cell, New Delhi. c) It is only upon failure of the pre-litigation mediation mechanism with Delhi High Court Mediation Cell then the aggrieved party shall resort to resolution of disputes through arbitration of a Sole Arbitrator. The appointing authority of Sole Arbitrator is CMD, WAPCOS Limited, to which neither of the parties have any objection nor they shall ever object. d) Subject to the parties agreeing otherwise, the Arbitration proceedings shall be conducted in accordance with the provisions of the Indian Arbitration and Conciliation Act, 1996 (amended as on date). e) It is also acknowledged and accepted that WAPCOS is only working as Intermediary between the Associate/Sub-Consultant/Sub-Contractor and the Principal Employer/Client, thus in the event, any dispute arises under the present agreement and referred to Arbitration for adjudication, then subject to corresponding clause in the Contract/Agreement/Work Order/Arrangement between Principal Employer/Client & WAPCOS, Principal Employer/Client shall also be made party to the said Arbitration proceedings. Also, the award including costs if any passed against WAPCOS and costs incurred in the proceedings shall be the sole responsibility of Principal Employer/Client. The said clause if found inapplicable, even then the other terms of the Arbitration

<table>
<tr><th>Clause No.</th><th>Description</th><th>Applicability/Modified/ Added</th></tr>
<tr><td></td><td></td><td>Clause shall survive and shall be acted upon.
f) The place/seat of arbitration shall be Delhi and any award whether interim or final, shall be made, and shall be deemed for all purposes between the parties to be made, in Delhi. The arbitral procedure shall be conducted in English language and any award or awards shall be rendered in English. The procedural law of the arbitration shall be Indian Law. The award of the arbitrator shall be final and conclusive and binding upon the Parties.
g) The Contract and any dispute or claim arising out of or in connection with it or its subject matter or formation (including non-contractual disputes or claims) shall be governed by and construed in accordance with the laws of India and the Parties submit to sole & exclusive jurisdiction of courts at Delhi.”</td></tr>
<tr><td>Clause 27</td><td>Lumpsum Provisions in Tender</td><td>Not Applicable</td></tr>
<tr><td>Clause 29B</td><td>Employment of coal mining or controlled area labour not permissible</td><td>Not Applicable</td></tr>
<tr><td>Clause 30B</td><td>Alternate water arrangements</td><td>Not Applicable</td></tr>
<tr><td>Clause 30</td><td>Return of surplus material</td><td>Not Applicable</td></tr>
<tr><td>Clause 36(i)</td><td colspan="2">Requirement of Technical Representative(s)
<table>
<tr><th rowspan="2">S.No.</th><th colspan="2">Requirement of Technical Staff</th><th rowspan="2">Minimum Experience (Yrs)</th><th rowspan="2">Designation of Technical Staff</th></tr>
<tr><th>Minimum Qualification</th><th>Numbers</th></tr>
<tr><td>1.</td><td>B.Tech (Civil)</td><td>1</td><td>10 (Having Experience of one similar nature of work)</td><td>Project Manager</td></tr>
<tr><td>3.</td><td>B.Tech (Electrical)</td><td>1</td><td>3</td><td>Electrical Engineer</td></tr>
<tr><td>4.</td><td>Diploma (Civil)</td><td>3</td><td>5</td><td>Construction Engineer/ Billing Engineer/ Quality Control</td></tr>
</table></td></tr>
</table>

Clause No.	Description			Applicability/Modified/ Added
				& Safety Engineer
	5.	Diploma (Electrical)	1	5	Electrical Works supervisor
	6.	Architect (B.Arch)	1	4	Architect and Interior Design Supervisor
Clause 39	Compensation During War Like Situation			Not Applicable
Clause46	Insurance			Applicable
Clause 48 (Sr. no 3 & 4)	Sr. No. 3: Certificates of Payment and Sr. No. 4: Payment			Not Applicable
Additional Condition	Quality control plan and site specific environment health and safety plan			The contractor shall provide the quality control plan and site specific environment health and safety plan before commencement of work.
Additional Conditions	Minimum Amount of Running Account Bill			The Contractor shall periodically submit Running Account (RA) bills for the gross work done not be less than Rs 50.00 lakh. for Construction. All running bills shall be accompanied with the Geo-tagged (GPS) clear photographs in sufficient number and angles illustrating the progress of work and for which claims raised in RA bill. The photographs shall be duly signed by the Contractor. The contractor shall submit the bill in the standard format agreed by the Client/ WAPCOS

2.0 ADDITIONAL CONDITIONS

1. The Contractor shall be responsible for consequential effects arising out during the inspection done by the Chief Technical Examiner Cell, Central Vigilance Commission or Committee constituted by the YSS or construction site visiting team of YSS or by the Building Works Committee or third party authorized by WAPCOS or any Statuary Committee or by any duly authorized representative of WAPCOS, during the progress or any time after the construction and development of project up to the defect liability period, and will take appropriate action for rectification of defective work and modifications as suggested by the above teams/ group/ individual. Rectification of defective works or replacement of sub- standard materials or articles or modifications, as pointed out by the Chief Technical Cell, Central Vigilance Commission, committee constituted by YSS, construction site visiting team of YSS, Building Works Committee or authorized representative of WAPCOS or third party authorized by WAPCOS or any Statuary Committee, will be carried out or replaced/modified by the Contractor at his own risk and cost.
2. The contractor shall get the Construction water, tested periodically from outside approved laboratory (within 2 months or early) and daily in site laboratory with regard to its suitability of use in the works and get written approval from the Engineer in charge before he proceeds

with the use of same of execution of works. The suitable water for construction shall be arranged by Contractor at his own cost and nothing extra shall be paid to the contractor on this account.

3. The contractor shall provide a fully equipped office cum Residential space for the Engineer-in-charge/site engineer with 24-hour electricity, electric fixtures (including ACs), drinking water supply, sanitary facilities, furniture, and the latest desktop computers with printers and internet connection at the construction site, along with any other miscellaneous requirements as directed by the Engineer-in-charge to finalize immediate technical solutions/decisions on site, ensuring that work progress is not hampered. Additionally, the contractor shall provide a residential flat for the Engineer-in-charge with a carpet area of 1000 sqft (2 or 3 BHK). The monthly expenses of the office will be borne by the contractor. An amount equal to 1% of the gross amount of running account bills and the final bill will be deducted if the above facilities are not provided on-site.
4. If any official of contractor is not following the directions of WAPCOS in the best interest of work, in that case, WAPCOS has full authority to get replaced that official from site of work with prior notice.
5. Contractor will ensure that work will be executed at site as per the rules and regulations of GRIHA council and maintain all rules and safety, environmental protocols, so that minimum GRIHA 3 Star rating as Green building shall be achieved for the work
6. Handing Over of the Project: Contractor will hand over the project to Owner /Client after successful completion of each component of the project along with submission of all the required documents i.e. As- built drawings, Inventory list, guarantee / warranty bonds, certificates & invoices of equipment, lock and key of each room and NoCs form various Departments with complete satisfaction and acceptance by WAPCOS/YSS. Contractor shall provide necessary Completion Certificate/NOC from all local Government/ Statuary Authorities including Fire, Forest, Electrical, Environment, Lift, DG Set, Complete inventory list, duly signed as-build drawings, required before handing over the project to the WAPCOS. The partial handing over of works components shall not be considered. Defect Liability period of *One (1) years will start from the date of successful completion of each component of the project and handing over to YSS/WAPCOS with all satisfaction & acceptance along with submission of all the required documents i.e. As- built drawings, Inventory list, guarantee / warranty bonds, certificates & invoices of equipment, lock and key of each room and NoCs form various Departments.*

7. All the modifications and any additional works (basic requirement after use of premises by user) suggested by client/WAPCOS at the time of handing over of the project and after occupancy of premises by client during Defect Liability Period must be taken up by contractor without any disputes and without any extra charge.
8. The contractor shall deploy the resources at site to start the construction after clearance from the Owner of the project and subsequent written approval from WAPCOS. No claim shall be entertained for idle labour, idle machinery, idle technical / non-technical staff, idle T&P if any, due to delay in start of the works.
9. Contractor shall deploy adequate technical manpower / expert of each relevant fields as per the scope and requirement of work during execution of work at site which are mandatory as per the standard guidelines.
10. If any dispute/ hindrance arises during construction due to any reason whatsoever, the contractor is not liable for any financial claim for damages due to such circumstances.
11. All Reinforced Cement Concrete work shall be design mix concrete of specified grade and initial

design mix shall be carried out from the Govt. approved Laboratory/NABL accredited lab/ NIT/IIT.

12. The Contractor shall render all help and assistance in documenting the total sequence of this project by way of photography, videography, slides, etc. nothing extra shall be payable to the Contractor on this account.

13. Quoted amount by contractor shall be firm and fixed for entire contract period as well as extended period for completion of the works. No escalation shall be applicable on this contract in any circumstances.

14. The contractor shall make his own arrangements for obtaining electric connection and water Connection/arrangement. The water charges and electricity charges as charged by Local Authorities will be paid by the Contractor. No dispute in this regard shall be entertained.

15. The contractor shall deploy the resources at site to start the construction after clearance from the Owner of the project and subsequent written approval from WAPCOS. No claim shall be entertained for idle labour, idle machinery, idle technical / non-technical staff, idle T&P if any, due to delay in start of the works.

16. All the rules and regulations about the Labour working at site and mandatory as per the State Government and Central Government departments will be followed by the contractor. If any issue arises in this regard will be resolved by the contractor. Contractor is liable to extend the benefits as provided under the various statutory and labour laws and other relevant applicable laws to its workforce. EPF/ESI and other labour laws being followed by State/Central Government norms and further amendments time to time would be followed by contractor. WAPCOS will not be a party for the issues related to EPF/ESI. If any type of the miss-happening during the execution of the project (i.e. Injury/Mobilization/Loss/Theft etc.) & the responsibility of skilled and un-skilled labor or any legal matter involved in this matter in the concerned jurisdiction will be borne by Contractor only.

17. The Contractor shall dispose of all the dismantled materials, debris, garbage, waste outside of the campus of the works at his own cost and provide clear and clean site at the time of handing over the works. Some restrictions may be imposed by the security staff etc. on the working and for movement for labour materials etc. The contractor shall be bound to follow all such restrictions / instructions and nothing extra shall be payable on this account.

18. The contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignment, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the contractor at his own cost to the instructions and satisfaction of the Engineer-in-Charge.

19. The cost/rates quoted by the contractor are deemed to be inclusive of site clearance, setting out work, profile, establishment of reference bench mark, spot levels, construction of all safety and protection devices, barriers, earth embankments, preparatory works, all testing of materials working during monsoon, working at all depths, height and locations etc. unless specified in the schedule of quantities.

20. Royalty at the prevailing rates wherever payable shall have to be paid by the contractor on the boulders, metal, shingle, sand and bajri etc. Or any other material collected by him for the work direct to revenue authorities and nothing extra shall be paid by the department for the same.

21. The contractor shall provide at his own cost suitable weighing, surveying and leveling and measuring arrangements as may be necessary at site for checking. All such equipment shall be got calibrated in advance from laboratory, approved by the Engineer-in-Charge. Nothing extra shall be payable on this account.

22. The contractor shall comply with proper and legal orders and directions of the local or public authority or municipality and abide by their rule and regulations and pay all fees and charges which he may be liable.

23. The contractor shall give a performance test of the entire installation (s) as per standing specification before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

24. Any cement slurry added over base surface (or) for continuation of concreting for better bond is deemed to have been in-built in the items and nothing extra shall be payable (or) extra cement considered in consumption on this account.

25. Samples of various materials required for testing shall be provided free of charges by the contractor. Testing charges, if any, unless otherwise provided shall be borne by the Contractor. All other expenditure required to be incurred for taking the samples, conveyance, packing etc. shall be borne by the contractor himself.

26. The contractor shall have to make approaches road to the site, if so required and keep them in good condition for transportation of labour and materials as well as inspection of works by the Engineer-in-charge. Nothing extra shall be paid on this account.

27. No payment shall be made for any damage caused by rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The contractor shall be fully responsible for any damage to the govt. property and work for which the payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The contractor shall be fully responsible for safety and security of his material, T&P, Machinery brought to the site by him.

28. The terms machine batched, machine mixed and machine vibrated concrete used elsewhere in agreement shall mean the concrete produced in concrete batching and mixing plant and if necessary transported by transit concrete mixers, placed in position by the concrete pumps, tower crane and vibrated by surface vibrator /needle vibrator / plate vibrator, as the case may be to achieve required strength and durability.

29. Wherever work is specified to be done or material procured through specialized agencies, their names shall be got approved well in advance from Engineer in charge. Failure to do so shall not justify delay in execution of work. It is suggested that immediately after award of work, contractor should negotiate with concerned specialist agencies and send their names for approval to Engineer in charge. Any material procured without prior approval of Engineer in charge in writing is liable to be rejected. Engineer in charge reserves right to get the materials tested in laboratories of his choice before final acceptance. Nonstandard materials shall not be accepted.

30. The construction joints shall be provided in predetermined locations only as decided by Engineer in charge. The cost of shuttering for these construction joints shall be included in item of Concrete work / RCC work and nothing extra shall be payable on this account to the contractor.

31. The gradation of fine sand to be used in plaster work, shall be strictly as per standard specification. The plastered surface shall be fairly smooth without any undulation of any kind for applying paint/white wash.

32. No chase cutting/dismantling of plaster/RCC/CC shall be allowed, so contractor has to execute the electrical work accordingly.

33. The contractor shall invariably prepare the samples of finishing items i.e. flooring of different types, external & internal finishing i/c colour scheme of paint, tiles in dado, flooring in

platforms & staircase, water supply & sanitary fittings and any other item as per direction of Engineer-in-charge. The contractor shall proceed with further finishing items only after getting the samples of these items approved in writing from Engineer-in-charge.

34. One sample room complete in all shape for each category, shall be prepared by the contractor and got approved from Engineer-in-charge in writing. The contractor shall be allowed to proceed with further rooms only after getting the sample room approved in writing from Engineer-in-charge No extra claim whatsoever beyond the payments due at agreement rates will be entertained from the contractor on this account.

35. The contractor shall establish a fully equipped site laboratory and shall provide electrically operated cube crushing and testing machine appliance at site, such as weighing, scale, graduated cylinder, standard sieves, thermometer, slump cones etc. all relevant tests for BMC / RMC as per prescribed IS codes in order to enable the Engineer in charge to conduct field tests to ensure that the quality is consistent with the prescribed specifications and nothing extra shall be paid on this account.

36. The contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case, he or his authorized representative is not present or does not associate himself, the results or such tests and consequences thereon shall be binding on the contractor.

37. The material shall conform to the quality and make as per attached list. However for the items not appearing in the list preference shall be given to those articles which bear ISI certification marks. In case articles bearing ISI certification marks are not available the quality of sample brought by the Contractor shall be judged by the standard laid down in the relevant ISI specification. All materials and articles brought by the contractor to the site for use shall conform to the samples approved, which shall be preserved till the completion of the work. Notwithstanding the case of materials of "Preferred Make" as given provisions of Clause 10A of the General Conditions of Contract for Central PWD works shall be applicable on the materials of "Preferred Make" also.

38. It must be ensure that all materials to be used in work bear BIS certification mark. In cases where BIS certification system is available for a particular material/product but not even a single producer has so far approached BIS for certification the material can be used subject to the condition that it should confirm to standard specification and relevant BIS codes. In such case written approval of the Engineer-In-Charge may be obtained before use of such material in the work.

39. The final approval of the brand to be used shall be as per the direction of Engineer-in-Charge. The brand used shall be one of the brands in case specified in the list of preferred make / materials.

40. All the rules and regulations about the Labour working at site and mandatory as per the State Government and Central Government departments will be followed by the contractor. If any issue arises in this regard will be resolved by the contractor. Contractor is liable to extend the benefits as provided under the various statutory and labour laws and other relevant applicable laws to its workforce. EPF/ESI and other labour laws being followed by State/Central Government norms and further amendments time to time would be followed by the contractor. WAPCOS will not be a party for the issues related to EPF/ESI. If any of the miss-happening during the execution of the project (i.e. injury/Mobilization/loss/theft etc.) & the responsibility of skilled and un-skilled labor or any legal matter involved in this matter in the concerned jurisdiction will be borne by Contractor only.

41. Special conditions for Cement

The contractor shall procure 43 grade Ordinary Portland Cement (conforming to IS: 8112), as required in the work, from reputed manufacturers of cement as per the list of approved makes or from any other reputed cement manufacturer, having a production capacity not less than one million tones per annum as approved by WAPCOS. The tenderers may also submit a list of names of cement manufacturers which they propose to use in the work. The tender accepting authority reserves right to accept or reject name(s) of cement manufacture(s) which the tenderer proposes to use in the work. No change in the tendered rates will be accepted if the tender accepting authority does not accept the list of cement manufactures, given by the tenderer, fully or partially. The cement brought to the site for execution of work shall be in bags bearing manufacturer's name & ISI marking. Weight of cement in each bag shall be 50 kg. Samples of cement arranged by the contactor shall be taken by the Engineer- in- Charge and got tested in accordance with provisions of relevant BIS codes. In case the test results indicate that the cement arranged by the contractor does not conform to the relevant BIS codes, the same shall stand rejected and it shall be removed from the site by the contractor at his own cost within 7 days of written order from the Engineer-in-Charge to do so.

42. Special Conditions for Steel:-

The contractor shall procure TMT bars of Fe500/Fe500D/Fe550/Fe550D grade (the grade to procured is to be specified) from primary steel producers as per the list of approved makes or any other producer as approved by WAPCOS who are using iron ore as the basic raw material / input and having crude steel capacity of 2.0 Million tonnes per annum and above.

43. Removal of rejected/sub-standard materials.

The following procedure shall be followed for the removal of rejected/sub-standard materials from the site of work:

(i) Whenever any material brought by the contractor to the site of work is rejected, entry thereof should invariably be made in the Site Order Book under the signature of the Engineer-In-Charge, giving the approximate quantity of such materials.

(ii) As soon as the material is removed, a certificate to that effect shall be recorded by the Engineer-In-Charge against the original entry, giving, the date of removal and mode of

removal, i.e., whether by truck, carts, or by manual labour. If the removal is by truck, the registration number of the truck should be recorded.

(iii) When it is not possible for the Engineer-In-Charge to be present at the site of work at the time of actual removal of the rejected/sub-standard materials from the site, the required certificate should be recorded by the Authorized Representative of WAPCOS, and the Engineer-In-Charge should countersign the certificate recorded by the Authorized Representative.

44. In case of works where a ready mix concrete (RMC) is stipulated to be used from an approved source/manufacturer, cement register need not be maintained. However, the computerized dispatch slips that are sent with each dispatch of RMC shall be kept as record.

45. If the work is carried out in more than one shift or during night, no claim on this account shall be entertained. The contractor has to take permission from the police & local authorities etc. if required for work during night hours. No claim / hindrance on this account shall be considered if work is not allowed during night time. The requisite supervision shall be made available by the WAPCOS along with necessary issue of material under joint custody.

46. Contractor should hand over the warranty of the specialized items to the WAPCOS.

47. Contractor shall submit all the Guarantee/ Warranty bond for the water proofing for 10 years of service warranty and Anti- Termite Treatment works for 5 years of service warranty.

48. The contractor is required to deploy resources as per availability of site. However, no claim will be entertained for idle labour, idle machinery, idle technical/no-technical staff, idle T&P etc.

49. Contractor shall not divert any advance payments or part thereof for any work other than that needed for completion of the contracted work. All advance payments received as per terms of the contract (i.e. mobilization advance, secured advance against materials brought at site, secured advance against plant & machinery and/or for work done during interim stages, etc.) are required to be re-invested in the contracted work to ensure advance availability of resources in terms of materials, labour, plant & machinery needed for required pace of progress for timely completion of work.

50. In case of any inconsistency between clauses, the clause favorable/ beneficiary to the project will prevail which will be decided by the owner and WAPCOS.

Clause: PREFERENCE TO MAKE IN INDIA

The provision of revised "Public Procurement (Preference to Make in India) Order 2017-Revision' Issued by Department of Industrial Policy and Promotion under Ministry of Commerce and Industry vide letter no.-P45021/2/2017-PP (BE-II) as amended on 16.09.2020 shall be applicable to the bidding process and award of the contract shall be done accordingly. In this connection, the minimum local content shall be 50% and the margin of purchase preference shall be 20%.

Verification of local Content

The bidder at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self –certification that the item offered meets the local content requirement of the tender. They shall also give details of the location at with the local value addition is made.

In cases of procurement for a value in excess of Rs. 10 crores, the bidder shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

Clause- Office Set up at Site for WAPCOS/Client officials

Vehicle for site visit, permanent one vehicle for WAPCOS officials for site monitoring like bolero/Scorpio should be provided during the entire tenure of construction and office set up at site for WAPCOS officials shall be provided by the contractor at his own cost. The Contractor shall provide uninterrupted power and water to the Office as directed for 24 hours free of cost. An amount equal to 1% of gross bill from all running account & final bill shall be recovered, if the above facilities are not provided by the Contractor

Clause - Insurance of Works Etc.

4.1 Contractor is required to take Contractor's All Risk policy from Nationalized insurance company in the joint name with Employer and bear all costs towards the same for the full period of execution of works including the Defect Liability Period for the full amount of contract against all loss of damage from whatever cause arising other than excepted risks for which he is responsible under the terms of the contract and in such manner that the Employer and the Contractor are covered during the period of construction of works and/or also covered during the period of Defect Liability for loss or damage.

a. The Works and the Temporary works to the full value of such works.

b. The materials, constructional plant, cantering, shuttering and scaffolding materials and other things brought to the site for their full value.

Whenever required by Employer, the Contractor shall produce the policy or the policies of insurance and the receipts for payment of the current premium.

4.2 Insurance under Workmen Compensation Act

Contractor is required to take insurance cover under the Workman Compensation Act, 1923 amended from time to time from Nationalized insurance company and pay premium charges thereof. Wherever required by Employer the Contractor shall produce the policy or the policies of Insurance and the receipt of payment of the current premiums.

4.3 Third Party Insurance

Contractor is required to take third party insurance cover for an amount of 5% (five percent) of contract value from Nationalized insurance company for insurance against any damage, injury or loss which may occur to any person or property including that of Employer / Owner, arising out of the execution of the Works or Temporary works. Wherever required by Employer the Contractor shall produce the policy or the policies of Insurance and the receipt of payment of the current premiums.

4.4 If the Contractor shall fail to effect and keep in force the insurances referred to above, or any other insurance which he may be required to effect under the terms of the Contract, then and in any such case the Employer on advice of the EIC may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Employer as aforesaid from any moneys due or which may become due to the Contractor, or recover the same as debt due from the Contractor.

4.5 The Contractor shall at all times indemnify Employer and Owner against all claims, damages or compensation under the provision of Payment of wages act-1936, Minimum Wages Act-1948, Employer's liability Act-1938, the workmen's compensation Act-1947, Industrial Disputes Act-1947 and Maternity Benefit Act-1961 or any modifications thereof or any other law in force or as consequence of any accident or injury to any workman or other persons in or about the works, whether in the employment of the Contractor or not, against all costs, charges and expenses of any suit, action or proceedings arising out of such incident or injury and against all sum or sums which may with the consent of the Contractor be paid to compromise or compound any such claim. Without limiting his obligations and liabilities as above provided, the Contractor shall insure against all claims, damages or compensation payable under the Workmen's Compensation Act 1923 or any modification thereof or any other law relating thereto.

4.6 The Contractor, in case of re-building or reinstatement after fire, shall be entitled to such extension of time for completion as the EIC may deem fit, but shall, however not be entitled to reimbursement by the Employer or any shortfall or deficiency in the amount finally paid by the Insurer in settlement of any claim arising as set out herein.

Clause : Management Meetings

8.1 Either the Engineer-in-Charge or the Contractor may require the other to attend a management meeting.

8.2 The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

8.3 The Engineer-in-Charge shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer-in-Charge either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

Clause : Co-operation & Co-ordination with other Agencies:

The Contractor shall have to make Coordination with other agencies engaged at the site by the Employer at no extra cost and share the Site with other Contractors/agencies, public authorities, utilities working in the area, if any. The Contractor will carry out the entire work in a planned manner by coordinating his work with other agencies, who will be simultaneously carrying out work in the same area and also co-ordinate in connection with the position of various fixtures, inserts, embedment's and other allied work connected with the completion of the building / subject work.

In case of any dispute between the agencies engaged on the same work, decision of Engineer-in-Charge shall be final and binding.

Clause : Employment of Staff for Plumbing & Electrical Works

- Employment of certified plumber: Certified plumbers should be employed by the Contractor on the work for main sewer, filtered and unfiltered main.
- Employment of licensed electrical foreman: The Contractor should employ a licensed electrical foreman to supervise the Electrical works

Clause : Watch and Ward and Lighting

The Contractor shall in connection with the works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or as required by the Engineer-in-Charge and duly constituted authority for the protection of the workers or for safety and convenience of the public or others. The Contractor shall be responsible for all damages and accidents caused due to negligence in this regard.

It will be the entire responsibility of the Contractor to protect the work(s) carried out by them including the fittings, fixtures and other accessories provided by them till the entire work is satisfactorily handed over to the Employer.

Clause: Third Party Inspection of Works

Notwithstanding the any other conditions of Contract, the Employer shall get the work inspected by any third party (IIT/ NIT as appointed by WAPCOS/Client) during the progress of work or any time after the construction and development of project up to the defect liability period. The Contractor, his consultant, subcontractors of all tiers and suppliers thereof shall make available during the inspection with all records necessary to demonstrate that the Works have been executed in accordance with the Contract Agreement.

The Contractor shall also be responsible for consequential effects arising out during the inspection done by the third party from time to time and will take appropriate action for rectification of defective work. Rectification of defective works or replacement of sub-standard materials or articles, as pointed out by the third party authorized by Employer, will be carried out or replaced by the Contractor at his own risk and cost. The Employer will not pay any extra amount for such rectification or replacement.

SECTION – V

ANNEXURES

ANNEXURE - I : FORMAT FOR PERFORMANCE SECURITY
ANNEXURE - II : FORMAT FOR ADVANCE PAYMENT BANK GUARANTEE
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Annexure – I

FORM OF PERFORMANCE GUARANTEE

WAPCOS Limited,
76-C, Sector 18, Institutional Area
Gurgaon, Haryana-122015.

In consideration of_____(Employer's name) (hereinafter referred to as "the Employer") which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to_____(Contractor's name & address) (hereinafter referred to as "the Contractor" which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) a contract, by issue of Employer's Notification of Award No._____dt. _____and the same having been unequivocally accepted by the Contractor, resulting into a contract valued at Rs._____(Rupees_____only) for _____(name of work) (hereinafter called "the contract") and the contractor having agreed to provide a Contract Performance Guarantee for the faithful performance of the entire contract equivalent to Rs._____(Rupees_____only) (5 % of the said value of the Contract to the Employer).

We,_____(name & address of bank) (hereinafter referred to as "the Bank" which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, on demand any or, all monies payable by the Contractor to the extent of Rs._____(Rupees _____only) as aforesaid at any time upto_____without any demur, reservation, contest , recourse or protest and/or without any reference to the Contractor or court. Any such demand made by the Employer on the bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall continue to be enforceable till the Employer discharges this guarantee.

We the said Bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said contract have been fully paid and its claims satisfied or discharged or till the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said Contractor and accordingly discharges the guarantee.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from, time to time to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor and to exercise the same at any time in any manner and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown

by the Employer or by any other matter or thing whatsoever which under law would but for this provision, have the effect of relieving the Bank. The guarantee shall not be affected by a change in the constitution of the bank or of the employer.

The bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance, without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

We The Said Bank do hereby declare that we have absolute and unconditional power to issue this guarantee in your favour under the Memorandum and Articles of Association or such other constitutional documents of the Bank and the undersigned have full power to execute this guarantee under the Power of Attorney / Post Approval Authorization dated _____of the bank granted to him / us by the Bank. We the said bank do hereby declare and undertake that your claim under the guarantee shall not be affected by any deficiency or other defect in the powers of the bank or its officials and the guarantee shall be deemed to have been issued as if the bank and its officials have all the powers and authorization to give this guarantee on behalf of the bank.

We the said bank do hereby certify the genuineness and appropriateness of the Stamp paper and stamp value used for issuing the guarantee. We the said bank do hereby declare and undertake that your claim under the guarantee shall not be affected by any deficiency or other defect in the stamp paper or its stamp value.

We the said bank do hereby declare that our payments hereunder shall be made to you , free and clear of and without and deduction, reduction on account of any reasons including any and all present and future taxes, levies, charges of withholding whatsoever imposed or collected with respect thereto.

Notwithstanding anything contained hereinabove our liability under this guarantee is restricted to Rs. _____(Rupees_____only) and it shall remain in force upto and including_____and shall be extended from time to time for such period as may be desired by M/s WAPCOS Limited to whom this bank guarantee has been given.

Notwithstanding anything contained herein

i) Our liability under this guarantee shall not exceed Rs. _____ (Rupees_____only);
ii) This bank guarantee shall be valid up to_____; and
iii) our liability to make payment shall arise and we are liable to pay the guaranteed amount or any part thereof under this guarantee, only and only if you serve upon us a written claim or demand in terms of the guarantee on or before_____**(indicate a date twelve month after validity of Guarantee**)

Dated this_____day of_____at New Delhi.

Annexure – II

FORM OF ADVANCE PAYMENT GUARANTEE

WAPCOS Limited,

76-C, Sector 18, Institutional Area

Gurgaon, Haryana-122015In consideration of WAPCOS LTD. (hereinafter referred to as "the Employer") which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to (Contractor's name) with its Registered /Head Office at (hereinafter referred to as "the Contractor" which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) a contract, by issue of Employer's Notification of Award No. dt. and the same having been unequivocally accepted by the Contractor, resulting into a contract valued at Rs. (Rupees only) for (hereinafter called "the contract") and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting to Rs. (Rupees only) as an advance against bank guarantee to be furnished by the Contractor.

We, (name & address of bank) having its Head Office at (hereinafter referred to as "the Bank" which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer immediately on demand any or, all monies payable by the Contractor to the extent of Rs. (Rupees only) as aforesaid at any time upto without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. We agree that the Guarantee herein contained shall be irrevocable and shall continue to be enforceable till the Employer discharges this guarantee. We further agree that no change in the constitution of the Bank or of the Employer shall affect this guarantee.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time, to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would but for this provision, have the effect of relieving the Bank.

The bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

We the Said Bank do hereby declare that we have absolute and unconditional power to issue this guarantee in your favour under the Memorandum and Articles of Association or such other constitutional documents of the Bank and the undersigned have full power to execute this guarantee under the Power of Attorney/ Post Approval Authorization dated_____of the bank granted to him / us by the Bank. We the said bank do hereby declare and undertake that your claim under the guarantee shall not be affected by any deficiency or other defect in the powers of the bank or its officials and the guarantee shall be deemed to have been issued as if the bank and its officials have all the powers and authorization to give this guarantee on behalf of the bank.

We the said bank does hereby certify the genuineness and appropriateness of the Stamp paper and stamp value used for issuing the guarantee. We the said bank does hereby declare and undertake that your claim under the guarantee shall not be affected by any deficiency or other defect in the stamp paper or its stamp value.

We the said bank do hereby declare that our payments hereunder shall be made to you , free and clear of and without and deduction, reduction on account of any reasons including any and all present and future taxes, levies, charges of withholding whatsoever imposed or collected with respect thereto. Notwithstanding anything contained hereinabove our liability under this guarantee is limited to Rs. _____(Rupees_____only) and it shall remain in force upto and including_____and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s_____on whose behalf this bank guarantee has been given.

Notwithstanding anything contained herein

i) Our liability under this guarantee shall not exceed R s ._____(Rupees _____only);

ii) This bank guarantee shall be valid upto_____and

iii) our liability to make payment shall arise and we are liable to pay the guaranteed amount or any part thereof under this guarantee, only and only if you serve upon us a written claim or demand in terms of the guarantee on or before_____**(indicate a date twelve months after the validity of the guarantee).**

Dated this_____day of_____at New Delhi.

WITNESS

_____	_____
(Signature)	(Signature)
_____	_____
(Name)	(Name)
_____	_____
(Official address)	(Designation with bank stamp)
_____	Attorney as Power of Attorney
(Signature)	No._____dt._____
_____	
(Name)	
_____	

ANNEXURE-III

FORMAT FOR INDENTURE FOR SECURED ADVANCES

THIS INDENTURE made the…… day of ……..20……. BETWEEN …… (hereinafter called the Contractor which expression shall where the context so admits or implies be deemed to include his executors administrators and assigns) of the one part and the WAPCOS (hereinafter called the WAPCOS which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.

WHEREAS by an agreement dated .....(hereinafter called the said agreement) the Contractor has agreed AND WHEREAS the Contractor has applied to the WAPCOS that he may be allowed advances on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges) AND WHEREAS the WAPCOS has agreed to advance to the Contractor the sum of Rupees …….. on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account Bill for the said works signed by the Contractor on ……and the WAPCOS has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works. Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees.....on or before the execution of these presents paid to the Contractor by the WAPCOS (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the WAPCOS and declare as follows: -

(1) That the said sum of Rupees ..... so advanced by the WAPCOS to the Contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor in or towards expediting the execution of the said works and for no other purpose whatsoever.

(2) That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the WAPCOS as security are absolutely the Contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contract or indemnifies the WAPCOS against all claims to any materials in respect of which an advance has been made to him as aforesaid.

(3) That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Divisional Officer …….. Division (hereinafter called the Divisional Officer) and in the term of the said agreement.

(4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Divisional Officer or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Divisional Officer.

(5) That the said materials shall not on any account be removed from the site of the said works except with the written permission of the Divisional Officer or an officer authorized by him on that behalf.

(6) That the advances shall be repayable in full when or before the Contractor receives payment from the WAPCOS of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the WAPCOS will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials then actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

(7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the WAPCOS shall immediately on the happening of such default be repayable by the Contractor to the WAPCOS together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs charges, damages and expenses incurred by the WAPCOS in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the WAPCOS to repay and pay the same respectively to him accordingly.

(8) That the Contractor hereby charges all the said materials with the repayment to the WAPCOS of the said sum of Rupees ..... and any further sum or sums advanced as aforesaid and all costs charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith the WAPCOS may at any time thereafter adopt all or any of the following courses as he may deem best :-

(a) Size and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay same to the WAPCOS on demand.

b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the WAPCOS under these presents and pay over the surplus (if any) to the Contractor.

(c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

(9) That except in the event of such default on the part of the Contractor as aforesaid interest on the said advance shall not be payable.

(10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be finally resolved as per provisions of clause 25 of the contract.

In witness whereof the said ……and.....by the order and under the direction of the WAPCOS have hereunto set their respective hands the day and year first above written.

Signed, sealed and delivered by.....the said contractor in the presence of .....

Signature ……

Witness Name……..

Address ……..

Signed by……..

by the order and direction of the WAPCOS in the presence of

Witness Name……..

Address ……..

Signed by……..

ANNEXURE-IV
FORMAT FOR SEEKING EXTENSION OF TIME

1. Name of contractor
2. Name of work as given in the agreement
3. Agreement no
4. Estimated amount put tender
5. Date of commencement of work as per agreement
6. Period allowed for completion of work as per agreement
7. Date of completion stipulated in agreement
8. Period for which extension of time already given

letter no. and date	Extension granted	
	Months	Days
(a) 1st extension		
(b) 2nd extension		
(c) 3rd extension		
(d) 4th extension		
(e) Total extension previously given		

9. Reasons for which extension have been previously given
10. Period for which extension if applied for
11. Hindrances on account of which extension is applied for with dates on which hindrances occurred.

Signature of Contractor

Dated .....

Annexure – V

FORMAT FOR GUARANTE BONDS / AFFIDAVTI FOR WORK

(On Rs. 100 non- Judicial Stamp Paper)

GUARANTEE TO BE EXECUTED BY THE CONTRACTOR FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATER SUPPLY AND SANITARY INSTALLATIONS, ROCK WOOL INSULATION AND POLYURETHENE FOAM

The agreement made this _____day of_____20_____between (Name of Contractor Firm)_____(hereinafter called the GUARANTOR of the one part) and the WAPCOS LIMITED (hereinafter called the WAPCOS of the other part).

WHEREAS THIS agreement is supplementary to a contract. (Herein after called the Contract) dated _____and made between the GUARANTOR OF THE ONE PART AND the WAPCOS of the other part, whereby the contractor interalia, under look to render the work in the said contract recited structurally stable workmanship and use of sound materials.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said work will remain structurally stable and guarantee against faulty workmanship, finishing, manufacturing defects of materials and leakages etc.

NOW THE GUARANTOR hereby guarantee that work executed by him will remain structurally stable, for the minimum life of ten years, to be reckoned from the date of start of Defect Liability Period prescribed in the Contract.

The decision of the Engineer-in-charge with regard to nature and cause of defects shall be final. During the period of guarantee the guarantor shall make good all defects to the satisfaction of the Engineer in charge calling upon him to rectify the defects, failing which the work shall be got done by the WAPCOS by some other contractor at the guarantor's cost and risk. The decision of the Engineer in charge as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to make good all the defects, commits breach thereunder then the guarantor will indemnify the Principal and his successor against all loss, damage cost expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and / or damage and / or cost incurred by the WAPCOS the decision of the Engineer-in-charge will be final and binding on the parties.

IN WITHNES WHEREOF those presents have been executed by the GUARANTOR _____on behalf of (Name of Contractor Firm) and_____by for and on behalf of the WAPCOS LIMITED on the day, month and year first above written.

Signed sealed and delivered by GUARANTOR in presence of:

1. _____
2. _____

SIGNED FOR AND ON BEHALF OF THE WAPCOS LIMITED BY_____in the presence of:

1. _____
2. _____

Annexure – VI

FORMAT FOR GUARANTE BONDS FOR WATER PROOFING

(On Rs. 100 non- Judicial Stamp Paper)

GUARANTEE BOND TO BE EXECUTED BY THE CONTRACTOR FOR WATER PROOFING TREATMENT FOR BASEMENT / TERRACE / TOILETS

The agreement made this _____day of_____20_____between (Name of Contractor Firm)_____(hereinafter called the GUARANTOR of the one part) and the WAPCOS LIMITED (hereinafter called the WAPCOS of the other part).

WHEREAS THIS agreement is supplementary to a contract. (Herein after called the Contract) dated _____and made between the GUARANTOR OF THE ONE PART AND the WAPCOS of the other part, whereby the contractor inter alia, undertook to render the structures in the said contract the work in the said contract recited completely water and leak proof.

THE GUARANTOR hereby guarantee that the water proofing treatment given by him will render the structures completely leak proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date of start of Defect Liability Period prescribed in the Contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects. The decision of the Engineer in charge with regard to cause of leakage shall be final.

During the period of guarantee the guarantor shall make good all defects and in case of any defects being found render the structure water proof to the satisfaction of the Engineer in charge at his cost and shall commence the work for such rectification within seven days from the date of issue of notice from the Engineer in charge calling upon him to rectify the defects, failing which the work shall be got done by the WAPCOS through some other contractor at the guarantor's cost and risk. The decision of the Engineer in charge as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to execute the water proofing, or commits breach thereunder then the guarantor will indemnify the Principal and his successor against all loss, damage, cost of expenses or otherwise which may be incurred by him by reason of any of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement . As to the amount of loss and / or cost incurred by the WAPCOS on the decision of the Engineer-in-charge will be final and binding on the parties.

IN WITHNES WHEREOF those presents have been executed by the GUARANTOR _____on behalf of (Name of Contractor Firm) and_____by for and on behalf of the WAPCOS LIMITED on the day, month and year first above written.

Signed sealed and delivered by GUARANTOR in presence of :

1. _____
2. _____

SIGNED FOR AND ON BEHALF OF THE WAPCOS LIMITED BY_____in the presence of :

1. _____
2. _____

Annexure – VII

FORMAT FOR GUARANTE BONDS FOR ANTI-TERMITE TREATMENT

(On Rs. 100 non- Judicial Stamp Paper)

GUARANTEE BOND TO BE EXECUTED BY THE CONTRACTOR FOR ANTI-TERMITE TREATMENT

The agreement made this _____day of_____20_____between (Name of Contractor Firm)_____(hereinafter called the GUARANTOR of the one part) and the WAPCOS LIMITED (hereinafter called the WAPCOS of the other part).

WHEREAS THIS agreement is supplementary to a contract. (Herein after called the Contract) dated _____and made between the GUARANTOR OF THE ONE PART AND the WAPCOS of the other part, whereby the contractor inter alia, undertook to render the wooden work in the said contract recited completely Termite proof.

THE GUARANTOR hereby guarantee that the anti-termite treatment given by him will render the wooden works completely Termite proof and the minimum life of such Anti-Termite treatment shall be five years to be reckoned from the date completion of work as period prescribed in the contract.

During the period of guarantee the guarantor shall make good all defects and in case of any defects being found render the wooden works termite proof to the satisfaction of the Engineer in charge at his cost and shall commence the work for such rectification within seven days from the date of issue of notice from the Engineer in charge calling upon him to rectify the defects, failing which the work shall be got done by the WAPCOS through some other contractor at the guarantor's cost and risk. The decision of the Engineer in charge as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to execute the Anti-termite works, or commits breach thereunder then the guarantor will indemnify the Principal and his successor against all loss, damage, cost of expenses or otherwise which may be incurred by him by reason of any of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement . As to the amount of loss and / or cost incurred by the WAPCOS on the decision of the Engineer-in-charge will be final and binding on the parties.

IN WITHNES WHEREOF those presents have been executed by the GUARANTOR _____on behalf of (Name of Contractor Firm) and_____by for and on behalf of the WAPCOS LIMITED on the day, month and year first above written.

Signed sealed and delivered by GUARANTOR in presence of :

1. _____
2. _____

SIGNED FOR AND ON BEHALF OF THE WAPCOS LIMITED BY_____in the presence of :

1. _____
2. _____

ANNEXURE – VIII
SAFETY CODES

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1(¼ horizontal and 1 vertical).

2. Scaffolding of staging more than 3.6 m (12ft.) above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.

4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm. (3ft.).

5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11½") for ladder upto and including 3 m. (10 ft.) in length. For longer ladders, this width should be increased at least ¼" for each additional 30 cm. (1 foot) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit; action or proceedings to any such person or which may, with the consent of the contractor, be paid to compensate any claim by any such person

6. (a) Excavation and Trenching - All trenches 1.2 m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100ft.) in length or fraction thereof, Ladder shall extend from bottom of the trench to at least 90 cm. (3ft.) above the surface of the ground. The side of the trenches which are 1.5 m. (5ft.) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m. (5ft.) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or undercutting shall be done.

(b) Safety Measures for digging bore holes:-

i. If the bore well is successful, it should be safely capped to avoid caving and collapse of the bore well. The failed and the abandoned ones should be completely refilled to avoid caving and collapse;
ii. During drilling, Sign boards should be erected near the site with the address of the drilling contractor and the Engineer in-charge of the work;
iii. Suitable fencing should be erected around the well during the drilling and after the installation of the rig on the point of drilling, flags shall be put 50m all-round the point of drilling to avoid entry of people;
iv. After drilling the bore well, a cement platform (0.50m x 0.50m x 1.20m) 0.60m above ground level and 0.60m below ground level should be constructed around the well casing;
v. After the completion of the bore well, the contractor should cap the bore well properly by welding steel plate, cover the bore well with the drilled wet soil and fix thorny shrubs over the soil. This should be done even while repairing the pump;
vi. After the bore well is drilled the entire site should be brought to the ground level.

7. Demolition - Before any demolition work is commenced and also during the progress of the work,

(i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
(ii) No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electrically charged.
(iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned. The following safety equipment shall invariably be provided.

(i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
(ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.
(iii) Those engaged in welding works shall be provided with welder's protective eye shields.
(iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
(v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measure are adhered to :-

(a) Entry for workers into the line shall not be allowed except under supervision of the JE or any other higher officer.

(b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
(c) Before entry, presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.
(d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.
(e) Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
(f) The area should be barricaded or cordoned of by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
(g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.
(h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.
(i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.
(j) Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
(k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 metres away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.
(l) The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the manhole.
(m) The workers shall be provided with Gumboots or non-sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.
(n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
(o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
(p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-Charge regarding the steps to be taken in this regard in an individual case will be final.

The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are

employed on the work of lead painting, the following precaution should be taken:-

(a) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.

(b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scrapped.

(c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.

9. The Contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form, wherever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use :

(i) White lead, sulphate of lead or product containing these pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.

(ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.

(iii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.

(iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

(v) Overall shall be worn by working painters during the whole of working period.

(vi) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.

(vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man.

(viii) WAPCOS may require, when necessary medical examination of workers.

(ix) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

10. When the work is done near any place where there is risk of drowning, all necessary equipment's should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.

11. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions :-

(i) (a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

(b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

(ii) Every crane driver or hoisting appliance operator, shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

(iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above

shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

(iv) In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.

12. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

13. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

14. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

15. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Engineer-in-Charge of the department or their representatives.

16. Notwithstanding the above clauses from (1) to (15), there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

ANNEXURE – IX
MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS EMPLOYED BY CONTRACTORS

1. APPLICATION

These rules shall apply to all buildings and construction works in which twenty or more workers are ordinarily employed or are proposed to be employed in any day during the period during which the contract work is in progress.

2. DEFINITION

Work place means a place where twenty or more workers are ordinarily employed in connection with construction work on any day during the period during which the contract work is in progress.

3. FIRST-AID FACILITIES

(i) At every work place, there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.

(ii) The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment:-

(a) For work places in which the number of contract labour employed does not exceed 50- Each first-aid box shall contain the following equipment's :-

1) 6 small sterilized dressings.
2) 3 medium size sterilized dressings.
3) 3 large size sterilized dressings.
4) 3 large sterilized burn dressings.
5) 1 (30 ml.) bottle containing a two per cent alcoholic solution of iodine.
6) 1 (30 ml.) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
7) 1 snakebite lancet.
8) 1 (30 gms.) bottle of potassium permanganate crystals.
9) 1 pair scissors.
10) 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
11) 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.
12) Ointment for burns.
13) A bottle of suitable surgical antiseptic solution

(b) For work places in which the number of contract labour exceed 50. Each first-aid box shall contain the following equipment's.

1) 12 small sterilized dressings.
2) 6 medium size sterilized dressings.
3) 6 large size sterilized dressings.

4) 6 large size sterilized burn dressings.
5) 6 (15 gms.) packets sterilized cotton wool.
6) 6.1 (60 ml.) bottle containing a two per cent alcoholic solution iodine.
7) 1 (60 ml.) bottle containing Sal volatile having the dose and mode of administration indicated on the label
8) 1 roll of adhesive plaster.
9) 1 snake bite lancet.
10) 1 (30 gms.) bottle of potassium permanganate crystals.
11) 1 pair scissors.
12) 1 copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour Institutes / Government of India.
13) A bottle containing 100 tablets (each of 5 gms.) of aspirin.
14) Ointment for burns.
15) A bottle of suitable surgical antiseptic solution.

(iii) Adequate arrangements shall be made for immediate recoupment of the equipment when necessary

(iv) Nothing except the prescribed contents shall be kept in the First-aid box.

(v) The first-aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.

(vi) A person in charge of the First-aid box shall be a person trained in First-aid treatment in the work places where the number of contract labour employed is 150 or more.

(vii) In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance from the works. First-aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.

(viii) Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or person suddenly taken ill to the nearest hospital.

4. DRINKING WATER

(i) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.

(ii) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.

(iii) Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and waterproof.

(iv) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING FACILITIES

(i) In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.

(ii) Separate and adequate cleaning facilities shall be provided for the use of male and female workers.

(iii) Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

6. LATRINES AND URINALS

(i) Latrines shall be provided in every work place on the following scale namely :-

(a) Where female are employed, there shall be at least one latrine for every 25 females.

(b)Where males are employed, there shall be at least one latrine for every 25 males. Provided that, where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females as the case may be up to the first 100, and one for every 50 thereafter.

(ii) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.

(iii) Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat-resisting nonabsorbent materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system.

(iv) (a) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers “For Men only” or “For Women Only” as the case may be.

(b) The notice shall also bear the figure of a man or of a woman, as the case may be.

(v) There shall be at least one urinal for male workers upto 50 and one for female workers upto fifty employed at a time, provided that where the number of male or female workmen, as the case may be exceeds 500, it shall be sufficient if there is one urinal for every 50 males or females upto the first 500 and one for every 100 or part thereafter.

(vi) (a) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.

(b) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.

(vii) Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.

(viii) Disposal of excreta: - Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed of by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with a 15 cm. layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).

(ix) The contractor shall at his own expense, carry out all instructions issued to him by the Engineer-in-Charge to effect proper disposal of night soil and other conservancy work

in respect of the contractor's workmen or employees on the site. The contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such on his behalf.

7. PROVISION OF SHELTER DURING REST

At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 ft.) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sqm (6 sft) per head.

Provided that the Engineer-in-Charge may permit subject to his satisfaction, a portion of the building under construction or other alternative accommodation to be used for the purpose.

8. CANTEENS

(i) In every work place where the work regarding the employment of contract labour is likely to continue for six months and where in contract labour numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the contractor for the use of such contract labour.

(ii) The canteen shall be maintained by the contractor in an efficient manner.

(iii) The canteen shall consist of at least a dining hall, kitchen, and storeroom, pantry and washing places separately for workers and utensils.

(iv) The canteen shall be sufficiently lighted at all times when any person has access to it.

(v) The floor shall be made of smooth and impervious materials and inside walls shall be lime washed or colour washed at least once in each year.

Provided that the inside walls of the kitchen shall be lime-washed every four months.

(vi) The premises of the canteen shall be maintained in a clean and sanitary condition.

(vii) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.

(viii) Suitable arrangements shall be made for the collection and disposal of garbage.

(ix) The dining hall shall accommodate at a time 30 per cent of the contract labour working at a time.

(x) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square metre (10 sft) per diner to be accommodated as prescribed in sub-Rule 9.

(xi) (a) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.

(b) Washing places for women shall be separate and screened to secure privacy.

(xii) Sufficient tables stools, chair or benches shall be available for the number of diners to be accommodated as prescribed in sub-Rule 9.

(xiii) (a) 1. There shall be provided and maintained sufficient utensils crockery, furniture and any other equipment's necessary for the efficient running of the canteen.

2. The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.

(b) 1. Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.

2. A service counter, if provided, shall have top of smooth and impervious material.

3. Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipment's.

(xiv) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.

(xv) The charges for food stuffs, beverages and any other items served in the canteen shall be based on 'No profit, No loss' and shall be conspicuously displayed in the canteen.

(xvi) In arriving at the price of foodstuffs, and other article served in the canteen, the following items shall not be taken into consideration as expenditure namely:-

(a) The rent of land and building.

(b) The depreciation and maintenance charges for the building and equipment provided for the canteen.

(c) The cost of purchase, repairs and replacement of equipment including furniture, crockery, cutlery and utensils.

(d) The water charges and other charges incurred for lighting and ventilation

(e) The interest and amounts spent on the provision and maintenance of equipment provided for the canteen.

(xvii) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

9. ANTI-MALARIAL PRECAUTIONS

The contractor shall at his own expense, conform to all anti-malarial instructions given to him by the Engineer-in-Charge including the filling up of any borrow pits which may have been dug by him.

10. The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral part of the contracts.

11. AMENDMENTS

Government may, from time to time, add to or amend these rules and issue directions - it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

ANNEXURE-X

Contractor's Labour Regulations

1. SHORT TITLE

These regulations may be called the C.P.W.D./PWD (DA) Contractors Labour Regulations.

2. DEFINITIONS

(i) Workman means any person employed by C.P.W.D./PWD (DA) or its contractor directly or indirectly through a subcontractor with or without the knowledge of the Central Public Works Department/PWD (DA) to do any skilled, semiskilled or unskilled manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment are expressed or implied but does not include any person :-

(a) Who is employed mainly in a managerial or administrative capacity : or

(b) Who, being employed in a supervisory capacity draws wages exceeding five hundred rupees per mensem or exercises either by the nature of the duties attached to the office or by reason of powers vested in him, functions mainly of managerial nature: or

(c) Who is an out worker, that is to say, person to whom any article or materials are given out by or on behalf of the principal employers to be made up cleaned, washed, altered, ornamental finished, repaired adopted or otherwise processed for sale for the purpose of the trade or business of the principal employers and the process is to be carried out either in the home of the out worker or in some other premises, not being premises under the control and management of the principal employer.

No person below the age of 14 years shall be employed to act as a workman.

(ii) Fair Wages means wages whether for time or piece work fixed and notified under the provisions of the Minimum Wages Act from time totime.

(iii) Contractors shall include every person who undertakes to produce a given result other than a mere supply of goods or articles of manufacture through contract labour or who supplies contract labour for any work and includes a subcontractor.

(iv) Wages shall have the same meaning as defined in the Payment of Wages Act.

3. (i) Normally working hours of an adult employee should not exceed 9 hours a day. The

(ii) When an adult worker is made to work for more than 9 hours on any day or for more than 48 hours in any week, he shall be paid over time for the extra hours put in by him at double the ordinary rate of wages.

(iii) (a) Every worker shall be given a weekly holiday normally on a Sunday, in provisions of the Minimum Wages (Central) Rules 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.

(b) Where the minimum wages prescribed by the Government under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same contractor for a continuous period of not less than 6 days.

(c) Where a contractor is permitted by the Engineer-in-Charge to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at overtime rate.

4. DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clear and legible condition in conspicuous places on the work, notices in English and in the local Indian languages spoken by the majority of the workers giving the minimum rates of wages fixed under Minimum Wages Act, the actual wages being paid, the hours of work for which such wage are earned, wages periods, dates of payments of wages and other relevant information as per Appendix 'III'.

5. PAYMENT OF WAGES

(i) The contractor shall fix wage periods in respect of which wages shall be payable.

(ii) No wage period shall exceed one month.

(iii) The wages of every person employed as contract labour in an establishment or by a contractor where less than one thousand such persons are employed shall be paid before the expiry of seventh day and in other cases before the expiry of tenth day after the last day of the wage period in respect of which the wages are payable.

(iv) Where the employment of any worker is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the second working day from the date on which his employment is terminated.

(v) All payment of wages shall be made on a working day at the work premises and during the working time and on a date notified in advance and in case the work is completed before the expiry of the wage period, final payment shall be made within 48 hours of the last working day.

(vi) Wages due to every worker shall be paid to him direct by contractor through Bank or ECS or online transfer to his bank account.

(vii) All wages shall be paid through Bank or ECS or online transfer.

(viii) Wages shall be paid without any deductions of any kind except those specified by the Central Government by general or special order in this behalf or permissible under the Payment of Wages Act 1956.

(ix) A notice showing the wages period and the place and time of disbursement of wages shall be displayed at the place of work and a copy sent by the contractor to the Engineer-in-Charge under acknowledgment.

(x) It shall be the duty of the contractor to ensure the disbursement of wages through bank account of labour.

(xi) The contractor shall obtain from the Junior Engineer or any other authorized representative of the Engineer- in-Charge as the case may be, a certificate under his signature at the end of the entries in the "Register of Wages" or the "Wage-cum-Muster Roll" as the case may be in the following form:-

(xii) "Certified that the amount shown in column No ..... has been paid to the workman concerned through bank account of labour on ..... at....."

6. FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES

(i) The wages of a worker shall be paid to him without any deduction of any kind except the following:-

(a) Fines

(b) Deductions for absence from duty i.e. from the place or the places where by the terms of his employment he is required to work. The amount of deduction shall be in proportion to the period for which he was absent.

(c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to his neglect or default.

(d) Deduction for recovery of advances or for adjustment of overpayment of wages, advances granted shall be entered in a register.

(e) Any other deduction which the Central Government may from time to time allow.

(ii) No fines should be imposed on any worker save in respect of such acts and omissions on his part as have been approved of by the Chief Labour Commissioner.
Note: - An approved list of Acts and Omissions for which fines can be imposed is enclosed at Appendix-X

(iii) No fine shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.

(iv) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to three paise in a rupee of the total wages, payable to him in respect of that wage period.

(v) No fine imposed on any worker shall be recovered from him by instalment, or after the expiry of sixty days from the date on which it was imposed.

(vi) Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

7. LABOUR RECORDS

(i) The contractor shall maintain a Register of persons employed on work on contract in Form XIII of the CL (R&A) Central Rules 1971 (Appendix IV)

(ii) The contractor shall maintain a Muster Roll register in respect of all workmen employed by him on the work under Contract in Form XVI of the CL (R&A) Rules 1971 (Appendix V).

(iii) The contractor shall maintain a Wage Register in respect of all workmen employed by him on the work under contract in Form XVII of the CL (R&A) Rules 1971 (Appendix VI).

(iv) Register of accident - The contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars:

(a) Full particulars of the labourers who met with accident.

(b) Rate of Wages.

(c) Sex

(d) Age
(e) Nature of accident and cause of accident.
(f) Time and date ofaccident.
(g) Date and time when admitted in Hospital,
(h) Date of discharge from the Hospital.
(i) Period of treatment and result of treatment.
(j) Percentage of loss of earning capacity and disability as assessed by Medical Officer.
(k) Claim required to be paid under Workmen's Compensation Act.
(l) Date of payment of compensation.
(m) Amount paid with details of the person to whom the same was paid.
(n) Authority by whom the compensation was assessed.
(o) Remarks

(v) The contractor shall maintain a Register of Fines in the Form XII of the CL (R&A) Rules 1971 (Appendix-XI) The contractor shall display in a good condition and in a conspicuous place of work the approved list of acts and omissions for which fines can be imposed (Appendix-X)
(vi) The contractor shall maintain a Register of deductions for damage or loss in Form XX of the CL (R&A) Rules 1971 (Appendix-XII)
(vii) The contractor shall maintain a Register of Advances in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIII)
(viii) The contractor shall maintain a Register of Overtime in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIV)

6. ATTENDANCE CARD-CUM-WAGE SLIP

(i) The contractor shall issue an Attendance card-cum-wage slip to each workman employed by him in the specimen form at (Appendix-VII)
(ii) The card shall be valid for each wage period.
(iii) The contractor shall mark the attendance of each workman on the card twice each day, once at the commencement of the day and again after the rest interval, before he actually starts work.
(iv) The card shall remain in possession of the worker during the wage period under reference.
(v) The contractor shall complete the wage slip portion on the reverse of the card at least a day prior to the disbursement of wages in respect of the wage period under reference.
(vi) The contractor shall obtain the signature or thumb impression of the worker on the wage slip at the time of disbursement of wages and retain the card with himself.

9. EMPLOYMENT CARD

The contractor shall issue an Employment Card in Form XIV of the CL (R&A) Central Rules 1971 to each worker within three days of the employment of the worker (Appendix-VIII).

10. SERVICE CERTIFICATE

On termination of employment for any reason whatsoever the contractor shall issue to the workman whose services have been terminated, a Service certificate in Form XV of the CL (R&A) Central Rules 1971 (Appendix-IX)

11. PRESERVATION OF LABOUR RECORDS

All records required to be maintained under Regulations Nos. 6 & 7 shall be preserved in original for a period of three years from the date of last entries made in them and shall be made available for inspection by the Engineer-in-Charge or Labour Officer or any other officers authorized by the Ministry of Urban Development in this behalf.

12. POWER OF LABOUR OFFICER TO MAKE INVESTIGATIONS OR ENQUIRY

The Labour Officer or any person authorized by Central Government on their behalf shall have power to make enquires with a view to ascertaining and enforcing due and proper observance of Fair Wage Clauses and the Provisions of these Regulations. He shall investigate into any complaint regarding the default made by the contractor or subcontractor in regard to such provision.

13. REPORT OF LABOUR OFFICER

The Labour Officer or other persons authorized as aforesaid shall submit a report of result of his investigation or enquiry to the Executive Engineer concerned indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the contractor's bill be made and the wages and other dues be paid to the labourers concerned. In case an appeal is made by the contractor under Clause 13 of these regulations, actual payment to labourers will be made by the Executive Engineer after the Superintending Engineer has given his decision on such appeal.

(i) The Executive Engineer shall arrange payments to the labour concerned within 45 days from the receipt of the report form the Labour Officer or the Superintending Engineer as the case maybe.

14. APPEAL AGAINST THE DECISION OF LABOUR OFFICER

Any person aggrieved by the decision and recommendations of the Labour Officer or other person so authorized may appeal against such decision to the Superintending Engineer concerned within 30 days from the date of decision, forwarding simultaneously a copy of his appeal to the Executive Engineer concerned but subject to such appeal, the decision of the officer shall be final and binding upon the contractor.

15. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER

(i) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by:-

(a) An officer of a registered trade union of which he is a member.

(b) An officer of a federation of trade unions to which the trade union referred to in clause (a) is affiliated.

(c) Where the employer is not a member of any registered trade union, by an officer of a registered trade union, connected with the industry in which the worker is employed or by any other workman employed in the industry in which the worker is employed.

(ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by :-

(a) An officer of an association of employers of which he is a member.

(b) An officer of a federation of associations of employers to which association referred to in clause (a) isaffiliated.

(c) Where the employers is not a member of any association of employers, by an officer of association of employer connected with the industry in which the employer is engaged or by any other employer, engaged in the industry in which the employer is engaged.

(iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these regulations.

16. INSPECTION OF BOOKS AND SLIPS

The contractor shall allow inspection of all the prescribed labour records to any of his workers or to his agent at a convenient time and place after due notice is received or to the Labour Officer or any other person, authorized by the Central Government on his behalf.

17. SUBMISSIONS OF RETURNS

The contractor shall submit periodical returns as may be specified from time to time.

18. AMENDMENTS

The Central Government may from time to time add to or amend the regulations and on any question as to the application/Interpretation or effect of those regulations the decision of the Superintending Engineer concerned shall be final.

NOTE: *Appendix & others mentioned in above labour regulation from I to XIV will be as per the General Conditions of Contract-2020 – Construction works of CPWD.*

SECTION – VI

FORMS

LETTER OF TRANSMITTAL

FORM-A : FINANCIAL INFORMATION

FORM-B : STRUCTURE & ORGANISATION

FORM C : NO CONVICTION CERTIFICATE

FORM D : UNDERSTANDING THE PROJECT SITE

FORM E : NO DEVIATION CERTIFICATE

FORM F : INTEGRITY PACT WITH INTEGRITY AGREEMENT

FORM G : FORMAT FOR LITIGATION HISTORY, LIQUIDATED DAMAGES, DISQUALIFICATION

LETTER OF TRANSMITTAL

(On Bidder **Original** *Letter Head)*

To
Chief Executive Director,
Environment & Construction Management
WAPCOS Limited,

Subject: Submission of bids for (Name of the Work/ Project)

Sir,

Having examined the details given in tender document for the above work, I/we hereby submit the relevant information.

1. I/we hereby certify that all the statement made and information supplied in the "Forms" enclosed with the tender and accompanying statement are true and correct.
2. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.
3. I/we submit the requisite certified solvency certificate and authorize the WAPCOS Ltd. to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/we also authorize WAPCOS Ltd. to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4. I/we submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following eligible similar works:

Name of work	Certificate from

Certificate:

It is certified that the information given in the enclosed eligibility bid are correct. It is also certified that I/we shall be liable to be debarred, disqualified / cancellation of enlistment in case any information furnished by me/us found to be incorrect.

Enclosures:

Seal of bidder

Date of submission: Signature(s) of Bidder(s).

TO BE SUBMITTED ON BIDDER ORIGINAL LETTER HEAD)

DECLARATION BY THE BIDDER

This is to certify that We, M/s ……., in submission of this offer confirm that:-

We have inspected the site of work and have made myself/ourselves fully acquainted with local conditions in and around the site of work. We have carefully gone through each & every section of the tender document for the work "**…… …….** (Name of work)".

1. Our tender is offered taking due consideration of all factors mentioned in tender documents.
2. We promise to abide by all the stipulations of the Contract documents and carry out and complete the work to the satisfaction of the Employer/ Principal Employer.
3. We also agree to procure Plants and Machineries at our cost required for the work. We also submit that we have Organizational Structure comprising adequate Technical Personnel in the line of requirement. We also agree to accomplish the job entrusted to us in the stipulated time laid out in document except situations not under our control.
4. We have not made any misleading or false representation in the forms, statement and attachments in proof of the qualification requirements;
5. We do not have records of poor performance such as abandoning the work, not properly completing the Contract, inordinate delays in completion or financial failures etc.
6. We have submitted all the supporting documents and furnished the relevant details as per prescribed format.
7. We are financially sound and have not applied or be under corporate debt restructuring.
8. List of Similar Works satisfying Qualification Criterion as indicated hereinafter, does not include any work which has been carried out by us through a Subcontractor on a back-to-back basis.
9. The Cost has been quoted by me/us for bid after taking into consideration all the terms and conditions stated in the Tender Document, our own estimates of costs and after a careful assessment of the site and all own the conditions that may affect the project cost and implementation of the project.
10. I / We shall keep this offer valid as period specified in the NIT.
11. I / We hereby submit our FINANCIAL BID and Offer Cost for undertaking the aforesaid Project in accordance with the Bidding Documents and the Agreement.
12. In the event of my/ our being declared as the Selected Bidder, I/we agree to enter into a Agreement in accordance with the format of Contract Agreement. We agree not to seek any changes in the aforesaid format of Contract Agreement and agree to abide by the same.

Certificate:

It is certified that the information given in the enclosed bid are correct. It is also certified that I/we shall be liable to be debarred, disqualified / cancellation of enlistment in case any information furnished by me/us found to be incorrect.

Date:

(Signature, Name, Designation
of the Authorized signatory with Seal)

Place:

FORM-A
FINANCIAL INFORMATION
[To be submitted on **Original** Letter Head of Bidder OR **Original** Letter Head of CA]

1. Financial Analysis: Details to be furnished duly supported by figures in balance sheet/ profit & loss account for the last five years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Years	Gross Annual turnover on construction works	Profit/Loss (After Tax)
2018-2019		
2019-2020		
2020-2021		
2021-2022		
2022-2023		

Signature of Chartered Accountant (with Seal and UDIN Number)

Signature of Bidder(s) (with Seal)

FORM –A-1

FORM OF SOLVENCY CERTIFICATE FROM A Nationalized SCHEDULED/Commercial BANK

To

CED (Envt & CM)
WAPCOS LIMITED
Plot No-76 C Intuitional Area Sector-18
Gurugram-122015

Name of the Work: (Name of the Work).

This is to certify that to the best of our knowledge and information that M/s/Sh…… having marginally noted address, a customer of our bank are/is respectable and can be treated as good for any engagement upto a limit of Rs……..(Rupees……)

This certificate is issues without any guarantee or responsibility on the bank or any of the officers.

Signature
(Email id of the bank)

NOTE:
1. Bankers Certificates should be on letter head of the Bank, addressed to tendering authority.
2. In case of Partnership firm, certificate should include names of all partners as recorded with the Bank.

(TO BE SUBMITTED ON BIDDER ORIGINAL LETTER HEAD)

FORM: CORRESPONDENCE DETAILS OF ISSUING AUTHORITY

Bank Guarantee/ Solvency / Banker's Certificate/ Completion Certificate

Name of Work: ……

1. **EMD submitted in form of DD/ FDR**

Present address of the Issuing Branch	Official Email Id	Landline no	Other Contact no

2. **Solvency Certificate / Banker's Certificate**

Present address of the Issuing Branch	Official Email Id	Landline no	Other Contact no

3. **Completion Certificate**

Present address of the Issuing Authority	Official Email Id	Landline no	Other Contact no

This is to certify that above information is correct and is gathered from the Issuing Authorities by us for the verification of concerned documents. We understand that if the documents is not verified by the issuing authority within 7 working days, then our bid is liable to be rejected.

Date:

(Signature, Name, Designation of the Authorized signatory with Seal)

Place:

FORM- B
STRUCTURE & ORGANISATION

S.No.	Particulars	Details Submitted by Bidder
1.	Name & address of the bidder	
2.	Telephone no./Telex no./Fax no.	
3.	Legal status of the bidder (attach copies of original document defining the legal status) (a) A proprietary firm (b) A partnership firm (c) A limited company or Corporation (d)A Company registered under company's Act 1956/2013	
4.	Particulars of registration with various Government Bodies (attach attested photocopy)	
	Organization/Place of Registration 1. 2. 3.	Registration No.
5.	Names and titles of Directors & Officers with designation to be concerned with this work.	
6.	Designation of individuals authorized to act for the organization	
7.	Has the bidder, or any constituent partner in case of partnership firm Limited Company/ Joint Venture, ever been convicted by the court of law? If so, give details.	
8.	In which field of Civil Engineering construction the bidder has specialization and interest?	
9.	Any other information considered necessary but not included above.	

Signature of Bidder(s)

FORM-C

FORMAT FOR NO-CONVICTION CERTIFICATE

[To be submitted on Bidder's Original Letter Head]

Subject: No-Conviction Certificate for --- (Name of the work / project)

This is to certify that _____(Name of the organization), having registered office at_____(Address of the registered office) has never been blacklisted or restricted to apply for any such activities by any Central / State Government Department or Court of law anywhere in the country.

This is also to certify that M/s_____(Name of the organization), is not involved in any form of Corrupt and Fraudulent Practices in past and will never be involved in future.

Yours faithfully,

Date: (Signature, name and designation of the Authorized signatory)

Place: **Name and seal of Bidder**

FORM-D

FORMAT FOR UNDERSTANDING THE PROJECT SITE

[To be submitted on Bidder's Original Letter Head]

To
Chief Executive Director,
Environment & Construction Management
WAPCOS Limited,

Subject: Undertaking of the Site Visit for --- (Name of the work / project)

Sir,

I/we hereby certify that I/we have examined & inspected the site & its surrounding satisfactorily, where the project is to be executed as per the scope of works. I/ We are well aware about the following

- Location of the site and accessibility to the site.
- Ground Water Level at construction site.
- Quality of ground water and availability of water surrounding to the Project.
- Termite effects at construction site & measures taken during construction of proposed site.
- Site clearance and location of matured trees.
- Topography and contouring of the land where the project is to be executed.
- Nature of the ground & sub-soil of the site as pile foundation is to be constructed
- Safety of Surrounding structures during excavation and during execution of work
- Hindrances, if any, which may arise during the execution of work

I / We hereby submit our BID considering above all facts gathered during site visit and each & every aspect have been considered in the Quoted Rates.

Yours faithfully,

Date:

Place:

(Signature, name and designation of the Authorized signatory)

Name and seal of Bidder

FORM-E

FORMAT FOR NO DEVIATION CERTIFICATE

[To be submitted on Bidder's **Original** Letter Head]

To
Chief Executive Director,
Environment & Construction Management
WAPCOS Limited,

Subject: No Deviation Certificate for (name of Work /Project)

With reference to above this is to confirm that as per Tender conditions we have visited site before submission of our Offer and noted the job content and site condition etc. We also confirm that we have not changed/modified the above tender document and in case of observance of the same at any stage it shall be treated as null and void.

We hereby also confirm that we have not taken any deviation from Tender Clause together with other reference as enumerated in the above referred Notice Inviting Tender and we hereby convey our unconditional acceptance to all terms & conditions as stipulated in the Tender Document.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null and void.

Yours faithfully,

Date:

(Signature, name and designation of the Authorized signatory)

Place:

Name and seal of Bidder

FORM-F
FORMAT FOR INTEGRITY PACT
[To be submitted on Bidder's **Original** Letter Head]

To,
WAPCOS LIMITED,
Plot No – 76-C, Institutional Area
Sector-18, Gurugram,
Haryana-122015

Sub: Integrity Pact for------- (Name of Work / Project)

Dear Sir,
I/We acknowledge that WAPCOS is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the tender/bid document at **Enclosure-I.**

I/We agree that the Notice Inviting Tender (NIT) is an invitation to offer made on the condition that I/We will sign the enclosed integrity Agreement, which is an integral part of tender documents, failing which I/We will stand disqualified from the tendering process. I/We acknowledge that THE MAKING OF THE BID SHALL BE REGARDED AS AN UNCONDITIONAL AND ABSOLUTE ACCEPTANCE of this condition of the NIT.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the main contract, which will come into existence when tender/bid is finally accepted by WAPCOS. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in the line with Article 1 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my/our failure to sign and accept the Integrity Agreement, while submitting the tender/bid, WAPCOS shall have unqualified, absolute and unfettered right to disqualify the tenderer/bidder and reject the tender/bid is accordance with terms and conditions of the tender/bid.

Yours faithfully,

Date: (Signature, name and designation of the Authorized signatory)

Place: **Name and seal of Bidder**

Enclosure-I

INTEGRITY AGREEMENT

[To be submitted on Stamp paper of At least Rs.100]

This Integrity Agreement is made at ..... on this ..... day of ..... 20.....

BETWEEN

WAPCOS Limited, New Delhi (Hereinafter referred as the **'EMPLOYER',** which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)
AND

.....
(Name and Address of the Individual/firm/Company)
through.....(Hereinafter referred to as the
(Details of duly authorized signatory)

"Bidder/Contractor" and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

Preamble

WHEREAS the Employer has floated the Tender (NIT No.....) (hereinafter referred to as "Tender/Bid") and intends to award, under laid down organizational procedure, contract for..... (Name of work) hereinafter referred to as the "Contract".

AND WHEREAS the Employer values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relation with its Bidder(s) and Contractor(s).

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as "Integrity Pact" or "Pact"), the terms and conditions of which shall also be read as integral part and parcel of the Tender/Bid documents and Contract between the parties.

NOW, THEREFORE, in consideration of mutual covenants contained in this Pact, the parties hereby agree as follows and this Pact witnesses as under:-

Article 1: Commitment of the Employer

(1) The employer commits itself to take all measures necessary to prevent corruption and to observe the following principles:

(a) No employee of the Employer, personally or through any of his/her family members, will in connection with the Tender, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

(b) The Employer will, during the Tender process, treat all Bidder(s) with equity and reason. The Employer will, in particular, before and during the Tender process, provide to all

Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the Tender process or the Contract execution.

(c) The Employer shall endeavour to exclude from the Tender process any person, whose conduct in the past has been of biased nature.

(2) If the Employer obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there be a substantive suspicion in this regard, the Employer will inform the Chief Vigilance Officer and in addition can also initiate disciplinary actions as per its internal laid down policies and procedures.

Article 2: Commitment of the Bidder(s)/Contractor(s)

(1) It is required that each Bidder/Contractor (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the WAPCOS all suspected acts of fraud or corruption or Coercion or Collusion of which it has knowledge or becomes aware, during the tendering process and throughout the negotiation or award of a contract.

(2) The Bidder(s)/Contractor(s) commits himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Tender process and during the Contract execution:

(a) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Employer's employees involved in the Tender process or execution of the Contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the Contract.

(b) The Bidder(s)/Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to cartelize in the bidding process.

(c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act. Further the Bidder(s)/ Contract(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information or documents provided by the Employer as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

(d) The Bidder(s)/Contractor(s) of foreign origin shall disclose the names and addresses of agents/ representatives in India, if any. Similarly Bidder(s)/Contractor(s) of Indian Nationality shall disclose names and addresses of foreign agents/representatives, if any. Either the Indian agent on behalf of the foreign principal or the foreign principal directly could bid in a tender but not both. Further, in cases where an agent participate in a tender on behalf of one manufacturer, he shall not be allowed to quote on behalf of another manufacturer along with the first manufacturer in a subsequent/parallel tender for the same item.

(e) The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.

(3) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

(4) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm indulge in fraudulent practice means a willful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and/or to influence the procurement process to the detriment of the WAPCOS interests.

(5) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm use Coercive Practices (means the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/her reputation or property to influence their participation in the tendering process).

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Employer under law or the Contract or its established policies and laid down procedures, the Employer shall have the following rights in case of breach of this Integrity Pact by the Bidder(s)/Contractor(s) and the Bidder/ Contractor accepts and undertakes to respect and uphold the Employer's absolute right:

(1) If the Bidder(s)/Contractor(s), either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Employer after giving 14 days' notice to the contractor shall have powers to disqualify the Bidder(s)/Contractor(s) from the Tender process or terminate/determine the Contract, if already executed or exclude the Bidder/Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Employer. Such exclusion may be forever or for a limited period as decided by the Employer.

(2) Forfeiture of EMD/Performance Guarantee/Security Deposit: If the Employer has disqualified the Bidder(s) from the Tender process prior to the award of the Contract or terminated/determined the Contract or has accrued the right to terminate/determine the Contract according to Article 3(1), the Employer apart from exercising any legal rights that may have accrued to the Employer, may in its considered opinion forfeit the entire amount of Earnest Money Deposit, Performance Guarantee and Security Deposit of the Bidder/Contractor.

(3) Criminal Liability: If the Employer obtains knowledge of conduct of a Bidder or Contractor, or of an employee or a representative or an associate of a Bidder or Contractor which constitutes corruption within the meaning of IPC Act, or if the Employer has substantive suspicion in this regard, the Employer will inform the same to law enforcing agencies for further investigation.

Article 4: Previous Transgression

(1) The Bidder declares that no previous transgressions occurred in the last 5 years with any other Company in any country confirming to the anticorruption approach or with Central Government or State Government or any other Central/State Public Sector Enterprises in India that could justify his exclusion from the Tender process.

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken for banning of business dealings/ holiday listing of the Bidder/Contractor as deemed fit by the Employer.

(3) If the Bidder/Contractor can prove that he has resorted / recouped the damage caused by him and has installed a suitable corruption prevention system, the Employer may, at its own discretion, revoke the exclusion prematurely.

Article 5: Equal Treatment of all Bidders/Contractors/Subcontractors

(1) The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact. The Bidder/Contractor shall be responsible for any violation(s) of the principles laid down in this agreement/Pact by any of its Subcontractors/sub-vendors.

(2) The Employer will enter into Pacts on identical terms as this one with all Bidders and Contractors.

(3) The Employer will disqualify Bidders, who do not submit, the duly signed Pact between the Employer and the bidder, along with the Tender or violate its provisions at any stage of the Tender process, from the Tender process.

Article 6: Duration of the Pact

(1) This Pact begins when both the parties have legally signed it. It expires for the Contractor/Vendor 12 months after the completion of work under the contract or till the continuation of defect liability period, whichever is more and for all other bidders, till the Contract has been awarded.

(2) If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged/determined by the Competent Authority, WAPCOS

Article 7: Other Provisions

(1) This Pact is subject to Indian Law, place of performance and jurisdiction is the Headquarters of the Employer, who has floated the Tender.

(2) Changes and supplements need to be made in writing. Side agreements have not been made.

(3) If the Contractor is a partnership or a consortium, this Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a Company, the Pact must be signed by a representative duly authorized by board resolution.

(4) Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intensions.

(5) It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement / Pact, any action taken by the Employer in accordance with this Integrity Agreement/ Pact or interpretation thereof shall not be subject to arbitration.

Article 8: LEGAL AND PRIOR RIGHTS

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and/or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both the Parties agree that this Integrity Pact will have precedence over the Tender/Contact documents with regard any of the provisions covered under this Integrity Pact.

IN WITNESS WHEREOF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses:

.....
(For and on behalf of Employer)

.....
(For and on behalf of Bidder/Contractor)

WITNESSES:
1. .....
(signature, name and address)

2. .....
(signature, name and address)

Place:

Dated :

FORM-G

FORMAT FOR LITIGATION HISTORY, LIQUIDATED DAMAGES, DISQUALIFICATION

[To be submitted on Bidder's **Original** Letter Head]

To,
Chief Executive Director,
Environment & Construction Management
WAPCOS Limited,

Subject: Litigation History, Liquidated Damages, Disqualification for ---------- (Name of Work /Project)

It is hereby declared that our firm (Name of firm with address --------) neither disqualified, nor have any Litigation history and no Liquidated Damage imposed on the firm by any Department.

Yours faithfully,

Date:

(Signature, name and designation of the Authorized signatory)

Place:

Name and seal of Bidder

FORM

Format of Undertaking to be furnished on Company Letter Head with regard to Blacklisting/Non-Debarment by the contracting Agency

Name of work:

Ref: Tender No…….dated…..

To

CED (Envt. & CM)
WAPCOS Limited
76-C , Industrial Area
Gurgaon, Haryana

This is to certify that we have taken the cognizance of Blacklisting Policy of WAPCOS Limited. Further, we hereby confirm and declare that we, M/s……., is not blacklisted/de-registered/debarred by any Government department/Public Sector Undertaking/Private Sector/or any other agency for which we have Executed/undertaken the works/services during the last 5 years.

For……..
Authorized Signatory
Date:-

FORM-H

DETAILS OF TECHNICAL AND ADMINISTRATIVE PERSONNEL TO BE EMPLOYED FOR THE WORK

S.No.	Designation	Total Number	Number Available for this Work	Name	Qualification	Professional experience and details of work carried out	How these would be involved in this project	Remarks
1	2	3	4	5	6	7	8	9

Signature of the Applicant

(TO BE SUBMITTED ON BIDDER ORIGINAL LETTER HEAD)

FORM-: - UNDERTAKING FOR MANPOWER DEPLOYMENT

Name of Work: ……

This is to certify that We, M/s……., in submission of this offer confirm that:-

Our tender is offered taking due consideration of all factors including site requirements information and conditions stated in the detailed Instructions to Bidders to execute the work up to the standards as laid out in Employer's Requirements and other sections of Tender Document.

We agree to employ the number of technical staff during the execution of this work as defined in the tender document. We shall deploy additional manpower as deemed fit and required to complete the project within stipulated completion period, without any additional cost to the Employer.

WAPCOS shall have full power and without giving any reason to us, immediately to get removed any representative, staff and workmen or employees on account of misconduct negligence or incompetence or whose continued employment may in his opinion be undesirable. We shall not claim any compensation on this account.

In case we fail to deploy the technical staff as mentioned in the tender document, we shall be liable to pay a sum of Rs. 50,000/- (Rupees fifty Thousand only) for each month of default in the case of each Graduate Engineer and Rs. 40,000/- (Rupees Forty Thousand only) in the case of each Diploma Engineer and details will be submitted with each Bill. We shall not raise any objection if deduction is made for the same from Running Bills.

Date:

(Signature, Name, Designation of the Authorized signatory with Seal)

Place:

FORM-

DETAILS OF ALL WORKS OF SIMILAR WORK NATURE COMPLETED DURING THE LAST SEVEN YEARS ENDING LAST DAY OF THE MONTH PREVIOUS TO THE ONE IN WHICH THE BIDS ARE INVITED

S.No.	Name of Work/ Project & location	Owner of Sponsoring Organization	Cost of Work in lakhs	Date of Commencement as per the contract	Stipulated Date of Completion	Actual Date of Completion	Litigation/ Arbitration pending/in progress with details*	Name & Address/Telephone no of officer to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

*Indicate gross amount claimed and amount awarded by the Arbitrator

Copy of work order and completion certificate of the above works should also be submitted and signed by the Executive Engineer or above rank official or its equivalent.

Signature of Applicant

FORM-K
UNDERTAKING
(Rule 144(xi) in the General Financial Rules (GFRs), 2017

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I hereby certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and Is eligible to be considered.

Date

Place

Signature, name and designation of the Authorized signatory)
Name and Seal of the bidder

SECTION – VII

SCOPE OF WORK

SECTION-VII
SCOPE OF WORK

- **BRIEF SCOPE OF WORK**

The scope of work includes the construction of the Indoor Hall-II/Multipurpose Hall at Chamba following the SAI guidelines with full satisfaction and handing over. The Scope of work shall include execution of work in accordance with Detailed Specifications of all the works; Tender Drawings, Architectural, Approved Structural & Services Drawings, list of Approved makes of works, General Technical specifications of works and other conditions stipulated in Tender Document. The contractor shall be responsible for procurement, transportation, providing, laying, fixing of all material required for the execution of work.

The Scope of work includes but not limited to:

1. Topographical Survey, Geotechnical Investigation, Preparation of Detailed Structural Drawings/GFC drawings (vetted from IIT/NIT) as per Architectural Drawings provided by WAPCOS.
2. Site Preparation & Leveling as required for the construction of the indoor hall complex and associated structure. Remove all grass and low vegetation and remove all bush wood, trees, stumps of trees, and other vegetation only after consultation with the Engineer-in-Charge as to which bushes and trees shall be saved.
3. Installation of Functional Site Office at Site and Installation of CCTV Cameras at site.
4. Construction of Footpath with 60 mm paver blocks and kerb stones.
5. Construction of Boundary Wall including the Retaining wall as required.
6. Prior to commencement of construction, the contractor shall in consultation with the Engineer-in-Charge, establish several site datum bench-marks, their number depending on the extent of the site. The bench-marks shall be sited and constructed so as to be undisturbed throughout the period of construction.
7. The contractor shall carry out the survey of the site and shall establish sufficient number of grids and level marks to the satisfaction of the Engineer-in- Charge, who shall decide on the basis of this information, the general level of the plot and the plinth.
8. Excavation in all type of soil, soft rock, hard rock without blasting and Filling Work. Earth work as required for construction of Indoor Hall complete in all respect.
9. Anti-Termite Treatment
10. Foundation Work- Concreting, Centering & Shuttering, Steel work complete in all respect.
11. Execution/Construction of the building (Civil Work) including beams, columns, concreting, brickwork, woodwork, flooring, finishing including plastering, pointing, painting as required.
12. Roofing/roof-work all in modular design.
13. Execution of the Exterior design.
14. Providing and placing Signboards as per directions of Engineer in Charge.
15. All aluminum Work, PVC work, other works required for the completion of the Structure.

16. All type of Plumbing, water supply, sanitary works and Electrical work required for the completion and operation of building/indoor stadium complex and as per the drawings provided,
17. Providing and installing power wiring & plugs, Lighting Conductors, Telephone Conduit System etc.
18. Providing and installing (01) No. of Water Cooler/Commercial Ro system for drinking water.
19. External electrical service connection to be provided.
20. Installation of Lift of 8 persons with 1m/s speed.
21. Providing and fixing pre-fabricated structure and roofing complete in all respect.
22. Providing and Installing 2000 Ltr Overhead Tank & 5000 Ltr Overhead tank without Independent Staging Height with Firefighting Provision.
23. Horticulture work including the plants etc as decorative things in the indoor hall complex as per the instructions of Engineer in Charge.
24. Providing and Installing Automatic Fire Alarm System, Fire Fighting with Wet Riser System.
25. All type of External Service Connections including sewerage connection, Power line connection, and Water Supply connection.
26. Construction/providing and installing water supply distribution line, storm water drain, service trenches.
27. Supplying installation testing and commissioning of 11kV/0.433KV Sub-Station equipment's comprising H.T. Panel, Transformer, HT Cable, Bus trunking from Transformer to LT Panel, LT Panel, Automatic power factor corrector panel, Essential Panel i/c Earthing, inter connecting power cables in sub-station, safety equipment's (Minimum 75 KVA or as per requirement).
28. Supplying installation testing and commissioning of Grid interactive roof top solar photo voltaic power generation system i/c space frame.(15 KW)
29. Supplying testing commissioning of IP based CCTV System for building security comprising of controllers, E&M Locks, reader, smart cards, cabling recording, display system, hardware and software support (Covering at least 1400 Sqm of area).
30. Supplying testing commissioning of Street Lighting (Covering at least 2200 Sqm of Area)
31. Providing and installation of sports flooring in Indoor hall and multi-purpose hall and badminton court mat (Yonex/Gerflor) (minimum 4 numbers) as per the norms of SAI and as per instruction of Engineer in Charge in Indoor hall and practice hall.
32. Providing and installing the 200 no. of specialized seating required for the indoor stadium.
33. Providing and installing movable net posts (minimum 4 Num) and net for badminton courts.
34. The works/buildings shall be designed to withstand static/dynamic loading (wind/seismic) and the design shall be strictly in accordance with the latest Indian Standard Code of Practices/National Building Code. The structural analysis and design shall be done by using latest version of software packages preferably **STAAD Pro/Etab**. The software used in the preparation of 2-D and 3-D drawings should be **AutoCAD, Revit Architect, and Navisworks.** The soft-copy files in DWG, RVT, and NWD formats shall also be submitted. The provisions in various BIS Codes shall override the packages output. The structural drawings shall be got vetted from any IIT before issuance for execution of works at site. The license for firefighting drawings should be taken from concerned local fire Department Authority
35. Providing and installing 4 number of Digital Score Board and referee chairs,
36. Complete indoor hall and associated structure constructed & ready for operation

complete in all respect with full satisfaction of YSS & WAPCOS.

37. Upon completion of the work all the areas should be cleaned. All floors, doors, windows, surface, etc. shall be cleaned down in a manner which will render the work acceptable to the Engineer-in-Charge. All rubbish due to any reason, shall be removed daily from the site and an area of up to ten metres on the outer boundaries of the premises will be cleaned by the contractor as a part of the contract. Upon completion of the project, the contractor shall turn over to the Engineer-in-Charge the following:
    - Written guarantee and certificates,
    - Maintenance manuals, if any, and
    - Keys.

1. The covered areas for the project are as follows:
    1. Ground Floor Area (Excluding Ramp, Entrance Lobby, entrance stairs as per tender drawing): 360 Sqm
    2. First floor excluding Canopy): 360 Sqm
    3. Indoor Hall (Prefabricated/pre-structured): 650 Sqm
    4. Equipment Store: 37.65 Sqm
    5. Other Facilities : As per Tender Drawings

NOTE: All sports equipment shall be provided as per the SAI/YSS guidelines and as per the instructions of YSS.

A. DESIGN AND DRAWINGS OF PROJECT / WORKS

The drawings given in the tender document to understand the detailed scope of the work only. Tender drawings will be revised/modified as per the site conditions, technical requirements as per the Indian Standard of Codes, and due to unforeseen conditions and as per the decision by Engineer In-charge.

Contractor will also submit Architectural drawings of the finishing works (flooring pattern/colour combinations/ type of tiling), external & Internal services, external & Internal development, all other as built drawings of entire covering area in totality etc. as per the specifications of work.

All the Civil/ Structural Design and Architectural drawings and GFC drawings as per the above approved architectural drawings are within the scope of contractor. The Contractor shall submit foundation layout plan, detailed structural drawings, electrical drawings, details Plumbing drawings and all the other necessary working drawings on the basis of approved Architectural drawings, technical specification and topographical survey considering all design loads as per the Indian Standard Codes at his own cost.

Contractor will submit the detailed Architectural drawings including Layout Plans, foundation details, Plans, Sections, Elevations, Façade, 3-D Views etc of project according to the enclosed tender drawings OR modified Architectural drawings (done by the Contractor only) as per the availability of land in line of tender drawings. All the Good for Construction (GFC) Drawings required for the execution of work as per the scope of work shall be prepared by the contractor.
All above architectural drawings and Structural Design & Drawings etc. of each and every aspect of the project shall be got vetted from WAPCOS Limited. Thereafter the contractor shall get the Structural Design & Drawings proof checked from the IIT/ NIT/ Reputed Institute or Licensed Structure Engineer (Structural drawing only) after approval from WAPCOS Limited. The fee payable for proof checking/vetting shall be

borne by Contractor. The approval of IIT/ NIT/ Reputed Institute or Licensed Structure Engineer shall be submitted to WAPCOS on letter head of the Institute (forwarding letter)/Firm along with the stamped and duly signed drawings.

The Contractor will submit the detailed PERT/CPM chart to WAPCOS after award of the work so that planning of release of stage-wise drawings may be ensured. The GFC drawings will be approved after scrutiny of the drawings by WAPCOS and proper approvals from Client. The Contractor may make advance planning according to the drawings attached with the Tender document as the drawings are detailed and comprehensive

The vetting of drawings from WAPCOS and approval of drawings by IIT/ NIT/ Reputed Institute or Licensed Structure Engineer does not absolves the contractor of their responsibility of structural stability and correctness of structural design. The contractor shall bear all the losses if arises out of the failure of any part of the project.

B. NOC'S / APPROVALS/ CLEARANCE OF PROJECT FROM LOCAL BODIES/ AUTHORITIES

The Contractor will take necessary Statuary Approval/ NoCs/ Clearance from all concern Local Authorities / Departments (DHVBN/ State Electricity board etc./ Electrical inspectorate/ pollution department/ forest department etc.), if any, required before start of the work / during the work / after execution of work & before handing over the Project.

The fee for getting these approval, shall be deposited by the Contractor to the concerned Department / Authorities and no extra cost for the same shall be claimed by the contractor.

The contractor shall mobilize the resources at site after getting approval / NoCs/ Clearance from all concern Local Authorities / Departments if any, essential before start of the construction and shall not make any claim due to any delay in approval.

C. GEOTECHNICAL INVESTIGATION

Soil exploration and soil investigation work shall be carried out by contractor immediately after the award of the work. Geo-technical investigation done on the nearby land is attached herewith the tender document for the understanding of the topography/soil characteristics only for that location. However, Contractor have to carry out fresh geo-technical investigation for the site on his own cost and submit the detailed report to this office.

After award of work, Contractor shall carry out detailed Geo technical investigation at its own cost through reputed NABL accredited laboratory only as detailed in tables below. The Scope of work shall comprise of in general, but not limited to the following for Geotechnical investigations.

a. Drilling of at least 4 nos boreholes upto a depth of 10m or refusal.

b. Conducting standard Penetration tests and collection of disturbed, undisturbed soil samples from boreholes.

c.Recording water table in the boreholes.

d. Laboratory tests on soil and water samples collected from boreholes.

e. Any other tests/works not specifically mentioned in this document but are required to ascertain the bearing capacity of soil at different depth, type of foundation and other engineering properties of the soil to the satisfaction of the Owner/ WAPCOS.

• Preparation and submission of soil reports (4 nos. hard bound final reports and soft copies). Contractor will submit soil report within 15 days from the date of award of work.

D. TOPOGRAPHICAL SURVEY

The detail Topographical Survey work of entire site has already been carried out by WAPCOS and enclosed with this tender Document in drawing section. However, Contractor/Bidder may carry out detail survey at his own cost, to verify the survey data provided by the WAPCOS and make own assessment about topography of site, before quoting rate and start of the Construction. No claim of Contractor in respect of discrepancy in topographical survey /levels shall be entertained.

2.0 WORKS OF THE PROJECT

The works of the project shall be executed as per Architectural, Approved Structural & Services Drawings, Bill of Quantity (If applicable), list of Approved makes of works, General Technical specifications of works and other conditions mentioned in the tender document. Contractor will finalize the brand of material in consultation with WAPCOS before execution of work from the following list of approved makes which are applicable for this work.
General Specifications to be followed:

The structure shall be constructed with prefabricated technology.

The flooring for the indoor hall shall be seamless synthetic polyurethane flooring over shock absorbing layer as approved by FIVB/FIBA/BWF OR other as per SAI standards.

The flooring in rooms, common areas and corridor shall be of vitrified tiles.

Kota stone flooring shall be provided for the store room & Staircases.

Granite Stone shall be provided in the entrance area.

Toilet shall be provided with non skid ceramic tile.

The wall finish paint with acrylic emulsion paint of approved brand and manufacture for interior grade on undecorated concrete/stone/plastered wall surfaces to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth including applying of putty a required for melting the surface.

The toilet walls shall be provided with ceramic tiles upto 2.1 m height and acrylic emulsion paint upto ceiling.

S.No.	Particular	Specification
1	Site	Jungle clearance, required levelling, dressing, cutting, filling up to plinth level and approach road up to construction site, barricading surrounding to construction site to isolate site from road and public, R.C.C Retaining wall. Installation of Functional Site Office and Installation of CCTV Cameras at Site.
2	Excavation	Earth work in all kind of soil/semi rock/ hard rock up to required depth as per the approved Drawings including de-watering.
3	Anti-Termite Treatment	Complete the anti-termite treatment below the plinth level all around the building for plinth protection.
	Pre Anti- Termite Treatment	After excavation for foundation, below PCC level by Diluting and injecting chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes With Chlorpyriphos/ Lindane E.C. 20% with 1% concentration from specialized agency with 10 years warranty period
	Post Anti-Termite Treatment	After earth filling at plinth level, below PCC of flooring by Diluting and injecting chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes with Chlorpyriphos/ Lindane E.C. 20% with 1% concentration from specialsied agency with 10 years warranty period
	Peripheral Post Anti-Termite Treatment	Along external wall where the apron is not provided using chemical emulsion @ 7.5 litres / sqm to a depth of 300mm with Chlorpyriphos/ Lindane E.C. 20% with 1% concentration from specialsied agency with 10 years warranty period
4	RCC sub and super structure	Depth of foundation as per the structural requirement/ design and soil investigation. Design as per IS Codes and as per Earthquake Seismic Zone Complaint, Wind forces. Structural load will be as per Standard IS Codes Required design Mix as per the structural

S.No.	Particular	Specification
		requirement/ design and approved drawings. RCC Framed Structure /Prefabricated Structure Shuttering and scaffolding for RCC works Construction/ expansion joints between RCC members by PVC Water stops confirming to IS: 12200 along with machine moulded Aluminum sheet for horizontal and vertical joints (80 to 300mm size) RCC fins as per the tender and approved drawings
5	Reinforcement	Thermo-Mechanically Treated bars of Fe500/550 or more grade. Design should be done on Etab/Staad pro latest version.
	Pre-Engineered Building (PEB)	
	Scope	This specification covers the design, materials, fabrication, and erection of a pre-engineered building (PEB) system. All work shall comply with applicable standards such as AISC, AISI, ASTM, and local building codes.
	Design	The structure shall be designed in accordance with relevant codes and standards. Design loads shall include dead loads, live loads, wind loads, snow loads, seismic loads, and any other applicable loads as per the governing codes. Appropriate safety factors shall be applied in the design to ensure stability and durability.
	Materials	High-strength, low-alloy steel shall be used for primary and secondary framing members. **Primary Members**: Hot-rolled or built-up sections. **Secondary Members**: Cold-formed sections such as purlins and girts. Roof and Wall Panels: Pre-painted galvanized steel or Galvalume panels with an appropriate thickness and coating. **Fasteners:** High-strength bolts, nuts, and
S.No.	Particular	Specification
		washers for structural connections. Self-drilling screws for panel connections

	Fabrication	All welding shall be performed by certified welders and conform to relevant standards. Members shall be fabricated to precise dimensions to ensure proper fit and alignment during erection. Steel components shall be coated or painted as specified to prevent corrosion
6	FILLER WALLS	
	Structure	RCC Framed structure with filler walls in Fly Ash Brick/ AAC blocks/ Non modular bricks of 230 mm thick in cement mortar 1:4 with intermediate or special chemical to join wherever necessary.
	Internal Partitions	1. Internal partition 115 mm Fly Ash Brick/ AAC blocks/ Non modular bricks in Cement mortar 1:3 including providing and placing 2 Nos. 6mm dia bars and lintel band as per structural requirement. 2. 66mm overall thickness Partition with 8mm thick double skin Calcium Silicate Board made with Calcareous & Siliceous materials reinforced with cellulose fiber manufactured through autoclaving process with Compressive Strength 225 kg/sq.cm, Bending Strength 100 kg./ sq.cm
		Providing Chicken Mesh at the joint of concrete and Brick work to avoid cracks.
	NOTE: Thickness of wall may vary with the size of Fly Ash Brick/ AAC blocks/ Concrete blocks/ Non modular bricks available at site.	
7	PLASTERING, PAINTING AND FINISHING	
a)	Internal	12/15 mm thick plaster in cm 1:4 over dubbing coat on uneven surface and finishing in even & smooth finish above skirting / dado on walls and ceilings with providing Chicken Mesh at the joint of concrete and Brick work. Internal walls and ceiling 2 mm or more thick (to maintain plumb) with PoP and putty over plastered

S.No.	Particular	Specification
		surface. 1st Quality Acrylic emulsion paint with 2 or more coat as per approved colour by client.
b)	External	20mm thick plaster in cm 1:4 mixed with waterproofing compound @3% weight of cement in two layer i.e. 12mm and 8mm as specified Fine Grain Finish Textured exterior paint of make Asian Paints- Apex Ultima Allura Venezio Or Equivalent of same specifications (if approved) with (two or more coats) applied over base coat of and with grooves patterns in paint as per manufacturer's shop drawing as per approved colour by client.. Sports playing art logo as per the approved drawings embossed over the finished textured paint surface. Structural Glazing Aluminium Composite Panel & vision glass panel as per approved drawings
8	FLOORING/ DADO/ SKIRTING/ SILL	
	Flooring and Dado : Main entrance, Reception Lobby , corridors in-front of blocks and corridors	Flooring: 19 mm thick pre polished Granite stone laid over 20mm screed in cm 1:4 over RCC / brick surface after applying coat of cement slurry @3kg/m2 as specified with proper edge moulding as per approved colour by client. Skirting: 100 mm high 19 mm thick pre polished granite stone with polishing.
	Flooring : Ramps flooring at Entrance	Flooring : Non- skid/ flamed 19 mm thick polished Granite stone Flooring with 200 mm skirting laid over 20mm screed in cm 1:4
	Flooring and skirting: Staircases of all blocks and stairs at entrance	Flooring: 19mm thick with combination of flamed and polished Granite stone (single piece) on tread & riser with proper edge moulding/ nosing and polishing with the arrangement of anti-skid (three) grooves as per approved colour by client. Skirting: 19 mm thick pre polished granite stone 200 mm High Skirting over 20 mm thick screed in CM 1:4 skirting

S.No.	Particular	Specification
	SILL : Windows sill, balconies sill and all other sills of building	19 mm thick polished Granite stone with proper edge moulding/ nosing and polishing as per approved colour by client.
9	FALSE CEILING (Gypsum Board, MR board, Calcium silicate 8mm, GRG board, perforated gypsum plaster board)	NOTE: Contractor shall also do the work of min. 12.5mm thick plaster in cm 1:4 in the ceiling areas where false ceilings is to be installed
	Common toilets	8mm thick Calcium silicate board with frames, fittings and fixtures
	Corridors and reception area	16mm thick Mineral Fiber tiles with frames, fittings and fixtures in combination with thick tapered edge gypsum fire resistant board/ Decorative Designer Gypsum Ceiling in surroundings / joints
10	DOOR & WINDOWS FRAME AND FITTINGS & FINISHING	
	Door Frame & finishing: Hostel rooms, studio units, common rooms, main gate of common toilet, dormatries, Surrounding stores & rooms of kitchen, back entrance, WC, Bathing area	Code 5753 "Factory made single extruded WPC (Wood Polymer Composite) solid door/window, clerestory windows & other Frames/Chowkhat of frame size 65 x 150 mm" Termite treated Wooden edge moulding / architectural moulded beading surrounding to door frames at inside and outside of door frame
11	DOOR & WINDOWS SHUTTERS	
	Door shutter & finishing: Hostel rooms, studio units, common rooms, main gate of common toilet, dormitories and back gate of kitchen area	Code No 5755: Factory made single extruded WPC (Wood Polymer Composite) solid plain flush door shutter 35 mm thick
S.No.	Particular	Specification

	Door shutter & finishing: Hostel rooms, studio units, common rooms, main gate of common toilet, dormitories and back gate of kitchen area	Code No 5755: Factory made single extruded WPC (Wood Polymer Composite) solid plain flush door shutter 35 mm thick
	Jali shutter & finishing: Hostel rooms, studio units, common rooms, main gate of common toilet, dormitories and back gate of kitchen area	Designer Mild steel door shutter of Fly proof stainless steel grade 304 wire gauge with 0.5 mm dia. Wire and 1.4mm wide aperture with painting and accessories of Mild steel (minimum weight- 25 Kg)
	Door shutter & finishing: Surrounding stores & rooms of kitchen, back entrance, WC, Bathing area	35mm thick flush door shutter fixed with all around wooden beading minimum 25 mm depth and both side 1.0 mm thick laminated sheet Factory made single extruded WPC (Wood Polymer Composite) solid plain flush door shutter 35 mm thick
	Door & window shutter & finishing: Balcony of Hostel rooms & studio units, main gate of dining hall, windows of dining area, window of kitchen and surrounding store area.	Providing and fixing factory made uPVC white colour casement/casement cum fixed glazed windows comprising of uPVC multi-chambered frame, sash and mullion (where ever required) extruded profiles duly reinforced with 1.60 ± 0.2 mm thick galvanized mild steel section made from roll forming process of required length (shape & size according to uPVC profile), uPVC extruded glazing beads of appropriate dimension, EPDM gasket, stainless steel (SS 304 grade) friction hinges, zinc alloy (white powder coated) casement handles, G.I fasteners 100 x 8 mm size for fixing frame to finished wall, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame & sash shall be mitred cut and fusion welded at all corners, mullion (if required) shall be also fusion welded including drilling of holes for fixing hardware's and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of

		required size and of approved quality, all complete as per approved drawing & direction of Engineer-in-Charge. (Single / double glass panes and silicon sealant shall be paid separately). Variation in profile dimension in higher side shall be accepted but no extra payment on this account shall be made. Casement window double panels with top fixed with S.S. friction hinges (350 x 19 x 1.9 mm) made of (small series) frame 47 x 50 mm, sash 47 x 68 mm & mullion 47 x 68 mm all having wall thickness of 1.9 ± 0.2 mm and single glazing bead of appropriate dimension. (Area of window upto 2.50 sqm). Casement cum fixed panel window having both end single casement panel, middle fixed panels and at top completely fixed ventilator with S.S friction hinges (350 x 19 x 1.9) made of (big series) frame 67 x 60 mm , sash 67 x 80 mm & mullion 67 x 80 mm all having wall thickness of 2.3 ± 0.2 mm and single glazing bead/double glazing bead of appropriate dimension. (Area of window above 3.00 sqm up to 5.00 sqm).
	Ventilator / Skylight above Doors	Covered with Stainless steel and 5mm thick clear glass where provision of skylight above doors
	Door Fittings & Accessories: All Fittings & accessories for all above wooden doors except studio units	Stainless Steel heavy duty matt finish such as Hinges, tower bolt 8 inches and 6 inches, L- drop, Handles, door Stopper, rubber spacer etc. and fitted by SS Screws only.

S.No.	Particular	Specification
	Door Fittings & Accessories: All Fittings & accessories for studio units	Stainless Steel heavy duty matt finish such as Hinges, tower bolt 8 inches and 6 inches, Mortice Lock (Basic min. MRP. Rs. 3500/-), door Stopper, rubber spacer etc. and fitted by SS Screws only.
	Corridor windows	Full size Fixed toughened glass (6mm thick) fixed with uPVC section as per requirement.
	All other windows and ventilators	Float glass of 5mm thickness fixed with Factory made champagne anodized 'z' uPVC section as per requirement / wooden section as per approved drawings. Windows may be fixed OR movable or open able
	Reception/ Entrance area	Full size Double door of toughened glass 12mm thick with stainless steel floor spring and fittings
12	FIRE DOORS	On each staircase of each floor and as per NBC fire safety norms.
13	CUPBOARD OF HOSTEL ROOM / STUDIO UNIT	
	Cupboard Shutter	18 mm thick Commercial Board shutter with 1mm thick Laminate on front and back side with lipping and all Stainless Steel heavy duty matt finish such as piano Hinges, handles, lock, hanger rod, tower bolt, SS screws etc.
	Cupboard shelves/ partition	18mm thick Kota stone partition slabs as per approved drawings with proper edge moulding and polishing
14	Parapet wall / RAILING	Providing and fixing stainless steel (Grade 304) railing made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement as per approval of Engineer-in charge, (for payment purpose only weight of
S.No.	Particular	Specification

		Stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.).
15	TOILETS AND DINING HAND WASH AREA	
	Counters	19 mm thick gang saw cut, mirror polished, pre- moulded and pre-polished, machine cut Granite stone
	Mirror	Frameless mirrors with SS fittings along full length of counter with warm back light.
	WC in toilets except studio unit	Floor mounted single peace European. Cat.No.92083 (S-30) hindware or equivalent.
	WC in studio unit	Wall mounted with concealed flush system Cat.No.92083 (S-30) hindware or equivalent.
	Wash basins	Wash basin fixed with Granite counter
	Urinals boys	European type with opaque partition board.
	Special Provision for handicapped bathrooms	All related fittings and fixtures as per the standard norms and Grab Bars provision
	Other fittings	As detailed in PHE works approved by Client/ WAPCOS
	NOTE: Modification in common bathroom / toilets may be made by client / WAPCOS as per the requirement of hostel building and usage by male/ female. All ,odels of pluming items should be at first approved by Clien/WAPCOS LTD	
16	KITCHEN OF STUDIO UNIT AND KITCHEN/ PANTRY / DINING/STORES/ COUNTERS & SURROUNDING AREA	
	All Counters of Kitchen, Pantry, Serving and Hand wash	19 mm thick gang saw cut, mirror polished, pre- moulded and pre-polished, machine cut Granite stone
	Shelves in different stores and below kitchen counter as per the requirement, standards and approved drawings	18 mm thick Kota stone/ white marble partition slabs with proper edge moulding and polishing
	Modular Kitchen	High-quality materials that are durable and easy to maintain
	Cupboard Shutter below kitchen, pantry, serving counter and to cover Shelves in different stores and below kitchen	18 mm thick Commercial Board shutter with 1mm thick Laminate on front and back side with lipping and all Stainless Steel heavy duty matt finish such as piano Hinges, handles, lock, hanger rod, tower bolt, SS screws etc.
S.No.	Particular	Specification
	counter as per the requirement, standards and approved drawings	

	Cupboard Shutter below kitchen, pantry, serving counter and to cover Shelves in different stores and below kitchen counter as per the requirement, standards and approved drawings	18 mm thick Commercial Board shutter with 1mm thick Laminate on front and back side with lipping and all Stainless Steel heavy duty matt finish such as piano Hinges, handles, lock, hanger rod, tower bolt, SS screws etc.
	Kitchen shelves over kitchen counter of studio unit	18 mm thick Commercial Board shutter and partition with 1mm thick Laminate on front and back side with lipping and all Stainless Steel heavy duty matt finish such as piano Hinges, handles, lock, hanger rod, tower bolt, SS screws etc.
17	Water proofing	
	Above plinth level	Damp Proof course as per standard norms and specifications
	UG Tank	
	Water Proofing outside	Kota Stone water Proofing in UG tank on Horizontal and Vertical wall
	Water Proofing Inside	Ist quality Ceramic Glazed Wall/ Floor Tiles of Size 300X300 mm on inside Horizontal and Vertical wall
	OH Tanks	
	Water Proofing outside	Integral Crystalline Slurry in OH Tanks Horizontal & Vertical
	Water Proofing Inside	Ist quality Ceramic Glazed Wall/ Floor Tiles of Size 300X300 mm on inside Horizontal and Vertical wall

S.No.	Particular	Specification
	Terrace and Mumty treatment	120 mm th. Brick bat coba over app modifies polymeric membranes water proofing treatment on rcc surface after applying a coat of cement slurry @3kg/m2 as specified. Gola on terrace all around parapet wall. Heat reflecting tiles will be laid over above water proofing works to reflect the as per the green building norms
18	PLUMBING WORK	
	Water supply pipes and fittings and joints	Chlorinated Polyvinyl Chloride (CPVC) for concealed works and GI for exposed works of required Pressure and diameter as per design and drawing (having thermal stability for hot & cold water supply including all CPVC plain and brass threaded fitting, valves etc. & including fixing the pipes with clampsate)
	Fire Fighting Tank- Pipe Connection and fittings and joints	Galvanized Iron (GI) of required Pressure and diameter as per design and drawing
	Soil waste pipes, Rain Water Pipes, vent pipes, anti- siphonage pipes, fittings & joints	Un-plasticized Polyvinyl Chloride (UPVC) PIPES of required Pressure and diameter as per design and drawing
	Rain Water pipe end to Rain water harvesting pit/ Catch Basin Connection	RCC Pipes of required Pressure and diameter as per design and drawing
	Gully Trap and Manhole Connections	Stoneware Pipes
	Note: The soil and waste pipe system shall be executed as “two piped system” as defined in IS: 5329.	

S.No.	Particular	Specification
	Water Cooler & Commercial RO (1 No.)	Supplying, fixing, testing and commissioning of Water Cooler of Storage Capacity of 150 litres and Normal Cooling Capacity of 150 litres per hour with features of stainless steel body, stainless steel tank, externally mounted thermostat makes it easy to set water temperature; speedy drainage; eco-friendly; faster cooling; silent during operation; auto-cut off at Dining Area of the Hostel Building with all fittings & accessories complete. Commercial Ro with Purification Production Rate 100 L/hr., Wall Mounted, Filter Cartridge- Sediment, Activated Carbon, UF, Post Carbon, Membrane Type-Thin Film Composite RO.
	Bathroom Fixtures	
	C.P. pillar cock long neck	Jaquar Cat. No. CON-021 or approved equivalent make
	C.P. brass waste	Jaquar Cat. No. ALD-709 or approved equivalent make
	C.P. bottle trap	Jaquar Cat. No. ALD-769B or approved equivalent make.
	Urinal	senso urinal HSI.Cat. No. 60018 or approved equivalent with C.I. hangers with built-in electronic solenoid valve operated auto flushing system complete with all electrical works required for completion of work with all required accessories.
	C.P. brass Bib Cock (Straight Line Model) With Wall Flange	Jaquar Cat NO. FLR-5047N or approved equivalent
	C.P. brass Bib Cock with Wall Flange	Jaquar Cat NO. OPL-15037 or equivalent make
	Stainless steel sink	Jaquar Cat. No. 767 or approved equivalent make Parko/Kingston with complete in all respect
	Single bowl with	940mm x 465mm x 178mm deep JAYNA JUPITER Cat. No. SBSD 02 or approvable

S.No.	Particular	Specification
	single drain board	Equivalent with CP brass mixing fittings Jaquar Cat. NO. 309 or approved equivalent
	C.P. brass towel ring	JAQUAR Cat No. ACN-1121N (CONTINENTAL SERIES) or approved equivalent complete with C.P. brass brackets fixed to rawl plug of approved design with C.P. brass screws
	S.S. hinged grating	1.5mm thick with frame (Neer Cat. No. - NRG 7006 or equivalent make CHILLY-CRG-R-127 (Square Classic)/JAYNA NEW HEAVY GRATINGS Cat. No. NHG 140 or approved equivalent
	Robe hooks,	JAQUAR Cat. No. 1161 or approved equivalent make
	Glass Bottle Liquid Soap Dispenser	JAQUAR Cat No. ACN-1135N Make or approved equivalent
	CP wall mixer non telephonic type	Jaguar Cat No. CON-CHR-219KN or approved equivalent
	shower rose with shower arm	Jaguar Cat No. OHS-1989 & SHA-477 or approved equivalent.
	Health Faucet	JAQUAR Cat. No. 573 (ALLIED SERIES) or equivalent make
	soap dish	Jaquar Cat. No. CAN-1131N or approved equivalent
	Towel Rail	24" JAQUAR Cat. No. ACN-1111NM or approved equivalent
	concealed stop cock	Jaquar Cat No. CON-089KN or approved equivalent
	Angle Valve with C.P. brass connection pipe	15mm C.P. brass Angle Valve with C.P. brass connection pipe Jaquar Cat No. CON-053KN & ALD-803B or equivalent make
	Toilet Paper Holder	JAQUAR Cat. No. ACN-1151N or equivalent make
19	FIRE FIGHTING	

S.No.	Particular	Specification
	FIRE HYDRANT SYSTEM	Fire hydrants fabricated from 16 gauge CRCA M.S. sheet double door including 2 nos allen key lock for locking along with padlock arrangement & fully glazed with 5 mm thick float glass approved by local Fire Authority, stove enameled fire red finish with " fire hose' written on front with radium strip suitable to house 15 m long four length of canvas hose with couplings, one no of branch pipe, one fire man's axe and two numbers of portable extinguishers, first aid fire hose and supports for hoses, branch pipes, Axe and hose reel as per approved design including necessary fixing arrangement for hoses & axe and branch pipe including 1 no. Fire booster pump (450 lpm). The nos. of fire hydrant system shall be as per the latest NBC norms. NOTE: The above specification of fire hydrant system and capacity of overhead fire tank shall be modified as per NBC norms, if number of storeys increased as per "Para-1A of Scope of work. No extra cost in this regard shall be entertained upto 6 storeys of proposed building.
	FIRE EXTINGUISHERS	ABC powder stored pressure type fire extinguishers consisting of welded MS cylindrical body, squeeze lever discharge valve fitted with pressure indicating gauge internal discharge tube, 30 cms long high pressure discharge hose, discharge nozzle, suspension bracket, conforming to ISI finished externally with red enamel paint and fixed to wall with brackets complete with internal charge. Capacity 6 kg. IS 13849. The nos. of fire extinguisher will be as per the latest NBC norms.
		Carbon-di-oxide fire extinguishers consisting of welded M.S cylindrical body, squeeze lever discharge valve fitted with internal discharge tube, 30cms long high pressure discharge hose, discharge nozzle, suspension bracket, confirming to IS : 934 finished externally with red enamel paint and fixed to wall with brackets with rawl plug/dash fasteners complete with internal charge. Capacity 4.5 kg. I.S.I. Marked. The nos. of

S.No.	Particular	Specification
		fire extinguisher will be as per the latest NBC norms.
	Fire Alarm System	Automatic smoke detector, electric Fire Alarm System for the hostel Building including MCP, Hooters, Control Panel with batteries & Charger Firefighting with wet riser system etc. The nos. of fire alarm system will be as per the latest NBC norms.
20	AIRCONDITIONER S	
	Split AC/ Window/ HVAC system	Details of the HVAC system type (e.g., central air conditioning, ductless mini-split, heat pump) and the reasoning behind its selection for my home. The cooling and heating capacity of the system, including calculations that demonstrate its suitability for the square footage and layout of my home. Features that enhance indoor air quality, such as air purifiers, dehumidifiers, or advanced filtration systems.
21	OTHER IMPORTANT	
	Passenger Lift	1 Nos. of Capacity 544 kgs. /8 passengers MRL Lift (only provision of lift well is to be made, installation of lift not in scope of contractor)
		Providing and installation of sports flooring in Indoor hall and multi-purpose hall and badminton court mat (Yonex/Gerflor) (minimum 4 numbers) as per the norms of SAI and as per instruction of Engineer in Charge in Indoor hall and practice hall.
	Landscaping	60mm paver block with PCC base & kerb stone edging on one side.
		Boundary wall with 1.5m high wall and 600mm high MS Grill including SS hallow structure gate at the entrance.
	Provision For Barrier Free Building	Ramps, toilets for physically challenged, Chequered tiles use of Braille signage's & lifts etc. as per the mandatory norms
S.No.	Particular	Specification

	Plinth Protection surrounding building	50 mm thick of cement concrete 1:3:6 (1 cement: 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including finishing the top smooth.(1250 mm Wide) with half brick masonry at corner of CC
	Rain water harvesting	Structure as per tender & approved drawings and storm water drainage network of the hostel building & amphitheater area should be connected with harvesting pit by PVC pipes / RCC pipes as per design drawings to recharge ground water by gravity flow.
	Waste disposal	After construction of building different colours of dustbins to be provided by the contractor to segregate dry and wet waste at minimum 3 locations as per the waste developed during running of hostel building.
	Sewerage system	Details of the type of sewerage system proposed (e.g., septic tank, central sewerage system, soak pit man hole sewer line gully trap combined sewer system etc)
	Storm water drain	Details of the type of storm water drain system proposed (e.g., surface drainage, subsurface drainage, or a combination The capacity of the system, including calculations that demonstrate its ability to handle expected rainfall and storm water runoff for construction area. A list of major components (e.g., pipes, catch basins, channels, drains)
22	ELECTRICAL WORKS	
A	AIRCONDITIONER S	
		Split AC, Window AC to be provide as per room volume norms electrical power points and with wiring for ACs.
b	Wiring	FRLS PVC insulated copper conductor of suitable size as per CPWD and IS specifications.
c	Conduits	Recessed Medium class PVC conduit of suitable size as per CPWD and IS specifications.
S.No.	Particular	Specification

d	Switch Sockets	Modular switch, sockets modular plate, suitable GI box of suitable size as per CPWD and IS specifications.
e	Telephone cable	0.5 mm dia FRLS PVC insulated annealed copper conductor
f	TV cable	co-axial TV cable RG-6 grade, 0.7 mm solid copper conductor PE insulated, shielded with fine tinned copper braid and protected with PVC sheath
g	Power station	Supplying installation testing and commissioning of 11kV/0.433KV Sub-Station equipment's comprising H.T. Panel, Transformer, HT Cable, Bus trunking from Transformer to LT Panel, LT Panel, Automatic power factor corrector panel, Essential Panel i/c Earthing, inter connecting power cables in sub-station, safety equipment's (Minimum 75 KVA or as per requirement).
h	Distribution board	Suitable way, horizontal/ vertical type three pole and neutral/single pole, sheet steel, MCB distribution board, 415 V/220 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. Separate DB for Light, Power and AC to be kept for each block on each floor as per latest CPWD specifications and IS codes
i	MCB/RCCB	"C" curve, miniature circuit breaker suitable for inductive load of suitable poles
j	Earthling (body)	G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of required length etc. with charcoal/ coke and salt as required.
k	Earthling (neutral of DG and Transformers)	Copper earth plate 600mm X 600mm X 3mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of required length etc. with charcoal/ coke and salt as required.
l	solar photo voltaic power generation system	Supplying installation testing and commissioning of Grid interactive roof top solar photo voltaic power generation system i/c space frame.(15 KW)
m	CCTV System	Supplying testing commissioning of IP based CCTV System for building security comprising of controllers, E&M Locks, reader, smart cards, cabling recording, display system, hardware and software support

		(Covering at least 1400 Sqm of area).
n	Particular	Specification
o	Cable Trench	Trench for underground service cables
p	Outdoor lightning	Street lights garden lights, lights on retaining wall Square lights (600X600), exhaust fans for toilets rooms, chimney for kitchen.
q	Earth strip	G.I and copper of suitable size as per IS Standards
r	Cable	PVC insulated and PVC sheathed / XLPE power cable of 1.1 kV grade of suitable size as per CPWD and IS specifications
s	Lighting Fixtures and Fans	Slim surface mounted LED lighting fixture Havells make - LHEAAVP5IL1W012 or equivalent. Slim surface mounted LED lighting fixture Havells make - LHEAAVP5IL1W018 or equivalent. Surface mounted LED lighting fixture Havells make – LHEXBLP7PN1W020 or equivalent. Surface mounted LED mirror lighting fixture Havells make - LHEXARP6PN1W009 or equivalent. 1200mm 5 star rated Ceiling fan sweep complete model no. White FHCES5SWHT48 of Havells make or equivalent Exhaust fan with 250 mm and 300 mm sweep with rust proof body and noise less operation complete with louvers. 4 star electric hot water 25 liters geyser Havells make catalogue no. PURO-PLUS-25 L or equivalent (min. 36 nos.)
t	Main Distribution Panel	CRCA sheet of 2 mm thick for frame work and covers , 3 mm thick for gland plates i/c cleaning and finishing complete with 7 tank process for powder coating in approved shade having suitable capacity extendable type TPN aluminum alloy bus-bars of high conductivity ,DMC/SMC bus bar support with short circuit withstand capacity of 31 MVA for 1 sec. including suitable rating MCCBs and MCBs and control circuit for transformer, DG sets and suitable number of outgoings as per CPWD, IS Specifications and site requirements.

		-Main LT Panel of hostel -Floor panels, light and power - AC Panels
u	Lighting arrestor	Lighting arrestor with suitable nos of earth pits, horizontal and vertical run of earth strip on parapet wall of hostel and up to the earth pits as per Indian standards
v	Safety Equipment	Suitable nos. of Rubber mat, fire extinguisher, danger board etc. as per IS.

CIVIL WORKS

General Technical Specifications

The General Technical Specification of Civil Works will be as per the provision within DSR/SOR, IS Codes, CPWD Specifications, Building Codes, approved drawings, Standard Norms and standard specifications of particular works. The following components shall be executed as per the given specifications:

List of Approved Makes of Civil Works

Acceptable makes of materials for civil work to be used in the work are enclosed. In case of non-availability of these makes, the Contractor can use the alternative makes only BIS marked materials after approvals. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

S.NO.	NAME OF ITEM	MAKE APPROVED
1	ORDINARY PORTLAND CEMENT GRADE 43/53,	JK, ACC, ULTRATECH, JAYPEE, AMBUJA
2	Ready Mix Concrete	From the RMC Plant of JK, ACC, LAFARGE, ULTRATECH, JAYPEE, AMBUJA companies or as finalized by GUG
3	WHITE CEMENT	JK, BIRLA, ACC, JAYPEE, AMBUJA
4	REINFORCEMENT STEEL	TATA , SAIL, RINL, JINDAL, JSW STEEL

5	PLY / BOARD / MDF	DURO, MERINO, GREEN PLY, AGNI , KITPLY, CENTURY
6	LOCK/BRASS FITTING	DORSET, DORMA, OZONE, GODREJ, HAFELE
7	WALL PUTTY	JK, BIRLA, ACRO, BERGER
8	STRUCTURAL STEEL/TUBULAR TRUSS	TATA , SAIL, RINL, JINDAL, APL APOLLO
9	PAINT/POLISH/ PRIMER/ WATER PROOFING PAINT	BERGER, ASIAN, DULUX, NEROLAC
S.NO.	NAME OF ITEM	MAKE APPROVED
10	POWDER COATING	AKZONOBEL, ASIAN
11	EPOXY PAINT/ WATER PROOFING WORKS	FIBREX/BASF/ SIKA/FOSROC
12	FLOOR & WALL TILE(VITRIFIED & CERAMIC)	KAJARIA, ORIENTBELL ,SOMANY, NITCO
13	GLASS / MIRROR	ASAHI, SAINT GOBAIN, PILKINGTON, MODI GUARD
14	CONSTRUCTION/WATERPROOFING CHEMICAL, ADMIXTURES	ROFFE, FOSROC, SIKA, ULTRACON, PIDILITE
15	ANTI TERMITE	VAM ORGANICS, PYRAMID, TERMISOL
16	GRID FALSE CEILING &	ARMSTRONG, DEXUNE, NEW AGE,
	WALL PARTITION	HUNTER DOUGLAS, SAINT GOBAIN
17	GYPSUM WALL PARTITION/CEILING	BORAL, INDIA GYPSUM, GYPROC, SAINT GOBAIN
18	FLUSH DOOR	DURO, CENTURY, MERINO, ARCHIDPLY, AGNI
19	DOOR FITTINGS & FIXTURES	DORMA, OZONE, DORSET, EBCO, HAFELE
20	GLASS/SS HANDRAIL	DORMA, OZONE, DORSET

21	ALUMINIUM SECTIONS	JINDAL, BHAROUKA, HINDALCO, ALUDECOR
22	XPS INSULATION	OWENS CORNING
23	GLASS PROCESSING	GOLDPLUS, GSC
24	MODULAR FURNITURE	GODREJ, BP ERGO, FEATHERLITE, WIPRO
25	VENEER/LAMINATE	MERINO, CENTURY, AGNI, DURO, GREEN,ARCHIDPLY
26	SIGNAGES	3M, XENON OR EQUIVALENT
27	Upvc Doors and Window	FENESTA, LINGAL, DECEUNINCK, ENCRAFT, DUROPLAST
28	PAVER BLOCK/KERB STONE of M30 Grade and 60 mm thick	NITCO,UNITILE, NIMCO OR EQUIVALENT
29	FIRE RETARDANT PAINT	NULLIFIER/SIGNUM/GODREJ/NIPPON/ CARBOLINE
30	FIREDOOR	SUKRI, NAVAIR, DORMA
31	FIRE RATED GLASS	SCHOTT (GERMANY) AND EQUIVALENT
32	PIPES RELATED WORKS	REFRE MAKE LIST FOR PHE WORKS
33	STAINLESS STEEL (GRADE 304) RAILING MADE OF	JINDAL, TATA, MONNET
.NO .	NAME OF ITEM	MAKE APPROVED
	HOLLOW TUBES, CHANNELS, PLATES ETC	
34	ACP	VIVA, ALSTRONG, ALUDECOR, ALUCOBOND, VIRGO
35	REINFORCEMENT COUPLER	SNTP, DEXTRA, MOMENT, LENTON
36	EXPANSION JOINT	KOHINOOR ENTERPRISES, MIGUA, CS
37	GLASS FIBER REINFORCEMENT CONCRETE	DALAL TILES, SHENISHA, BIRLA

ELECTRICAL WORKS

GENERAL TECHNICAL SPECIFICATION

The General Technical Specification of Electrical Works will be as per the Bill of Quantities, provision within DSR/SOR, IS Codes, Building Codes, approved drawings, CPWD Specifications, Standard Norms and standard specifications of particular works.

LIST OF APPROVED MAKES FOR ELECTRICAL

Acceptable makes of materials for electrical and fire alarm work to be used in the work are enclosed. In case of non-availability of these makes, the Contractor can use the alternative makes only BIS marked materials after approvals. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

ITEM	**MANUFACTURERS NAME**
Air Circuit Breaker	Schneider /Siemens/ L&T/ABB
Moulded Case Circuit Breaker With rotary operating handle.	Schneider/ Siemens/ L&T/ ABB/ Polycab
Transformer / Compact Substation	ABB/ Schneider/ Kriloskar/ Crompton
Digital meters	El Measure / L&T/ Conserve/ Trinity / Neptune Ducati
Contactors, Timers	Schneider/ ABB/ L & T/ Legrand/ Siemens
Capacitors / capacitor with relay	Schneider/ EPCOS/ L & T
Voltmeter & Ammeter	Conzerve/ Enersol/ HPL
Switch Gear	Schneider/ Siemens/ L&T/ ABB/ Crompton
Selector Switch	Kaycee/ L & T
Current Transformer	Matrix/AE/ C&S / G&M
Indicating Lamp	L & T/ Siemens/ AE
Protective Relays	ABB/ L & T /Siemens/Schneider / GE
Multi functional meter	L&T/ Legrend/ Conzerv
APFC Relay (Microprocessor based)	Syntron/ Enercon/ L & T/ Ducati/
ITEM	MANUFACTURERS NAME

	Schneider
Batteries	Exide/Amar Raja/Okaya/Luminous
Battery Charger	Uptron/Voltstat Electronics
L.T. / H.T. Cable	Polycab/ Havells/ Finolex/ KEI
DC Miniature Circuit Breaker	Schneider/Siemens/Polycab/ Legrand
Cable Lug (Tinned Copper)	Dowells/ Multi/Capital
Cable Gland	Peeco/ Commet/ Gripwell/ Power
Main L.T. Panel, Capacitor Panel & Distribution Panel	SPC Electrotech/ Tricolite/ Adlec/ Application Control/ Precision
Cable Tray / Raceway	Pilco/CTM Engineers/KME/Slotco/Steelways
Fire Extinguishers	Zenith/Minimax/Newage/ Cease Fire
Energy Analyzer Meter	Conzerve/Elemeasure/Enersol
Voltmeter & Ammeter	Conzerve/ Elmeasure/ Enersol
Distribution Boards with Miniature Circuit Breakers, RCCB	Hager/Legrand/ polycab/L & T/ Havells
PVC Insulated copper conductor single core Stranded wires of 650/1100 volt grade	Havells/finolex /Polycab
Telephone Tag Block	Krone/ TVS R&M
PVC Conduit	BEC/AKG/polycab/ RMCON/ ASTRAL
M.S. Conduit	BEC/AKG / RMCON/ JINDAL
Modular Switches & Sockets	Legrand/Havells/polycab/ Anchor
LV System Wire	Siemens/Legrand/ Amp/ Havells/polycab
TV/Telephone outlet	Siemens/Legrand/ Havells/polycab
Data Outlet	Siemens/Legrand/ Havells/polycab
Data Rack	Siemens/APW/Legrand/ Wipro
Light Fixture	Philips/Havells/polycab/ wipro
RCC Hume Pipe for Electrical Works	ISI Marked of Reputed Company
PLC	Siemens/Allen Bradley
Telephone / Co axial Wire	Polycab/finolex/Havells
Professional LED Panel	Panasonic/ Samsung/Sony
Public Address System	Honeywell/ Bosch/Tyco/Edwards
D.G. Set (Engine)	Cummins/Catterpillar/Stamford/Kirloskar

ITEM	MANUFACTURERS NAME
D.G. Set (Alternator)	Stamford/ LerroySommer/ Catterpillar
D.G. Accoustic Enclosure	Jakson/Sterling/CatterPiller/Sudhir
H.T. Panel	ABB/ Schneider/Siemens
H.T. Termination Kit	Raychem/Denson
Smoke Detectors	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Heat Detectors	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Manual Call Box	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Hooter/ Sounder	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Response Indicator	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Fire Panel	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Pa Amplifier	Honeywell/ Bosch/Heinrich/Aties
Pa Speakers	Honeywell/ Bosch/Heinrich/Aties
Line Matching Transformer	Honeywell/ Bosch/Heinrich/Aties
Goose Neck Mike	Honeywell/ Bosch/Heinrich/Aties
Inverter	Topaz International/ Luminous/ Hytes/ Su-kam/ Microtech
Camera With All Accessories	Axis / Inpulse/ Idis/ Bosch/Pelco
Road Barrier	Nice/ Magnetics/ Godrej/ GE
Card Reader	Sensormatic-Usa/ Motorola /Honeywell(Xls-3000)
Monitor	LG/ Samsung/Sony
Multiplexer	Sensormatic Or Equivalent
Sequencer	Alba/ Vantage

ITEM	MANUFACTURERS NAME
Proximity Card	Motorola/ Hughes/ Honeywell/GE/Siemens/Hid
Telephone Tag Block	Ctm Engg/Systimax/Schneider/Panduit
Telephone Cables	Delton / Skytone/ Clipsal/ havells
Co-Axial Cables	Finolex/ havells/ polycab
EPABX	Alkatel/ Siemens/ Nec/ Avaya/ Panasonic
CCTV System	Axis / Impulse/ Idis/ Bosch/ Honneywell /Tyco
Access Control System	Honeywell/ Siemens/Syris
Video Conference System	Polycom/Sony/Sysco
Audio Processor	Bose/Bss/Clearone
Bms Controller/Software Central Control Bms Server	Ibm/Hp/Dell
Building Management System, Building management Web Based Server Software, Programmable & Application Specifier Controller	Siemens/Honeywell Ebi/Tyco / Schneider
Sensor & Field Devices Immersion Type Temperature Sensors, Flow Meter,Ultra Sonic Thermal Energy Meter , Outside T+Rh Sensor	Siemens/Kele/Sauiter Race
Water Level Switches, Flame Proof Level Switches	Kele/ Veskler/Flipro
Dc Voltage Transducer, Current Relay	Kele/Situ/Omicron
Room Type Temp. Sensor, Co2 Sensor, Ambient Temp. Sensor	Siemens/Kele/Trane
Co Sensor	Dwyer/Kale/Msr German
Pressure Transmitter	Siemens/Trane/Omicron
Differential Pressure Sensor	Siemens/Trane/Veskler
Fire Suppression System	Siemens/Kidde/Tyco
High Mast and Poles	Bajaj Electricals / My Fair Light/ Paruthi Engineering
Service/ Passenger Elevators	Kone/Schindler/OTIS

3.0 CIVIL WORKS

3.1 General Technical Specifications

The General Technical Specification of Civil Works will be as per the provision within DSR/SOR, IS Codes, CPWD Specifications, Building Codes, approved drawings, Standard Norms and standard specifications of particular works. The following components shall be executed as per the given specifications:

3.2 List of Approved Makes of Civil Works

Acceptable makes of materials for civil work to be used in the work are enclosed. In case of non-availability of these makes, the Contractor can use the alternative makes only BIS marked materials after approvals. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

S.NO.	NAME OF ITEM	MAKE APPROVED
1	ORDINARY PORTLAND CEMENT GRADE 43/53, PORTLAND POZZOLONA CEMENT	JK, ACC, ULTRATECH, JAYPEE, SHREE, AMBUJA
2	Ready Mix Concrete	From the RMC Plant of JK, ACC, LAFARGE, ULTRATECH, JAYPEE, SHREE, AMBUJA companies or as finalized by GUG
3	WHITE CEMENT	JK, BIRLA, ACC, JAYPEE, AMBUJA
4	REINFORCEMENT STEEL	TATA , SAIL, RINL, JINDAL, JSW STEEL
5	PLY / BOARD / MDF	DURO, MERINO, GREEN PLY, AGNI , KITPLY, CENTURY
6	LOCK/BRASS FITTING	DORSET, DORMA, OZONE, GODREJ, HAFELE
7	WALL PUTTY	JK, BIRLA, ACRO, BERGER

S.NO.	NAME OF ITEM	MAKE APPROVED
8	STRUCTURAL STEEL/TUBULAR TRUSS	TATA , SAIL, RINL, JINDAL, APL APOLLO
9	PAINT/POLISH/ PRIMER/ WATER PROOFING PAINT	BERGER, ASIAN, DULUX, NEROLAC
10	POWDER COATING	AKZONOBEL, ASIAN
11	EPOXY PAINT/ WATER PROOFING WORKS	FIBREX/BASF/ SIKA/FOSROC
12	FLOOR & WALL TILE(VITRIFIED & CERAMIC)	KAJARIA, ORIENTBELL ,SOMANY, NITCO
13	GLASS / MIRROR	ASAHI, SAINT GOBAIN, PILKINGTON, MODI GUARD
14	CONSTRUCTION/WATERPROOFING CHEMICAL, ADMIXTURES	ROFFE, FOSROC, SIKA, ULTRACON, PIDILITE
15	ANTI TERMITE	VAM ORGANICS, PYRAMID, TERMISOL
16	GRID FALSE CEILING & WALL PARTITION	ARMSTRONG, DEXUNE, NEW AGE, HUNTER DOUGLAS, SAINT GOBAIN
17	GYPSUM WALL PARTITION/CEILING	BORAL, INDIA GYPSUM, GYPROC, SAINT GOBAIN
18	FLUSH DOOR	DURO, CENTURY, MERINO, ARCHIDPLY, AGNI
19	DOOR FITTINGS & FIXTURES	DORMA, OZONE, DORSET, EBCO, HAFELE
20	GLASS/SS HANDRAIL	DORMA, OZONE, DORSET
21	ALUMINIUM SECTIONS	JINDAL, BHAROUKA, HINDALCO, ALUDECOR
22	XPS INSULATION	OWENS CORNING
23	GLASS PROCESSING	GOLDPLUS, GSC
24	MODULAR FURNITURE	GODREJ, BP ERGO, FEATHERLITE, WIPRO
25	VENEER/LAMINATE	MERINO, CENTURY, AGNI, DURO, GREEN,ARCHIDPLY
26	SIGNAGES	3M, XENON OR EQUIVALENT
27	Upvc Doors and Window	FENESTA, LINGAL, DECEUNINCK, ENCRAFT, DUROPLAST
28	PAVER BLOCK/KERB STONE of M30 Grade and 60 mm thick	NITCO,UNITILE, NIMCO OR EQUIVALENT
29	FIRE RETARDANT PAINT	NULLIFIER/SIGNUM/GODREJ/NIPPON/ CARBOLINE
30	FIREDOOR	SUKRI, NAVAIR, DORMA
31	FIRE RATED GLASS	SCHOTT (GERMANY) AND EQUIVALENT
32	PIPES RELATED WORKS	REFRE MAKE LIST FOR PHE WORKS
33	STAINLESS STEEL (GRADE 304) RAILING MADE OF	JINDAL, TATA, MONNET

S.NO.	NAME OF ITEM	MAKE APPROVED
	HOLLOW TUBES, CHANNELS, PLATES ETC	
34	ACP	VIVA, ALSTRONG, ALUDECOR, ALUCOBOND, VIRGO
35	REINFORCEMENT COUPLER	SNTP, DEXTRA, MOMENT, LENTON
36	EXPANSION JOINT	KOHINOOR ENTERPRISES, MIGUA, CS
37	GLASS FIBER REINFORCEMENT CONCRETE	DALAL TILES, SHENISHA, BIRLA

4.0 ELECTRICAL WORKS

4.1 GENERAL TECHNICAL SPECIFICATION

The General Technical Specification of Electrical Works will be as per the Bill of Quantities, provision within DSR/SOR, IS Codes, Building Codes, approved drawings, Standard Norms and standard specifications of particular works.

4.2 LIST OF APPROVED MAKES FOR ELECTRICAL

Acceptable makes of materials for electrical and fire alarm work to be used in the work are enclosed. In case of non-availability of these makes, the Contractor can use the alternative makes only BIS marked materials after approvals. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

ITEM	MANUFACTURERS NAME
Air Circuit Breaker	Schneider /Siemens/ L&T/ABB
Moulded Case Circuit Breaker With rotary operating handle.	Schneider/ Siemens/ L&T/ ABB/ Polycab
Transformer / Compact Substation	ABB/ Schneider/ Kriloskar/ Crompton
Digital meters	El Measure / L&T/ Conserve/ Trinity / Neptune Ducati
Contactors, Timers	Schneider/ ABB/ L & T/ Legrand/ Siemens
Capacitors / capacitor with relay	Schneider/ EPCOS/ L & T
Voltmeter & Ammeter	Conzerve/ Enersol/ HPL
Switch Gear	Schneider/ Siemens/ L&T/ ABB/ Crompton
Selector Switch	Kaycee/ L & T
Current Transformer	Matrix/AE/ C&S / G&M
Indicating Lamp	L & T/ Siemens/ AE
Protective Relays	ABB/ L & T /Siemens/Schneider / GE
Multi functional meter	L&T/ Legrend/ Conzerv
APFC Relay (Microprocessor based)	Syntron/ Enercon/ L & T/ Ducati/ Schneider
Batteries	Exide/Amar Raja/Okaya/Luminous

ITEM	MANUFACTURERS NAME
Battery Charger	Uptron/Voltstat Electronics
L.T. / H.T. Cable	Polycab/ Havells/ Finolex/ KEI
DC Miniature Circuit Breaker	Schneider/Siemens/Polycab/ Legrand
Cable Lug (Tinned Copper)	Dowells/ Multi/Capital
Cable Gland	Peeco/ Commet/ Gripwell/ Power
Main L.T. Panel, Capacitor Panel & Distribution Panel	SPC Electrotech/ Tricolite/ Adlec/ Application Control/ Precision
Cable Tray / Raceway	Pilco/CTM Engineers/KME/Slotco/Steelways
Fire Extinguishers	Zenith/Minimax/Newage/ Cease Fire
Energy Analyzer Meter	Conzerve/Elemeasure/Enersol
Voltmeter & Ammeter	Conzerve/ Elmeasure/ Enersol
Distribution Boards with Miniature Circuit Breakers, RCCB	Hager/Legrand/ polycab/L & T/ Havells
PVC Insulated copper conductor single core Stranded wires of 650/1100 volt grade	Havells/finolex /Polycab
Telephone Tag Block	Krone/ TVS R&M
PVC Conduit	BEC/AKG/polycab/ RMCON/ ASTRAL
M.S. Conduit	BEC/AKG / RMCON/ JINDAL
Modular Switches & Sockets	Legrand/Havells/polycab/ Anchor
LV System Wire	Siemens/Legrand/ Amp/ Havells/polycab
TV/Telephone outlet	Siemens/Legrand/ Havells/polycab
Data Outlet	Siemens/Legrand/ Havells/polycab
Data Rack	Siemens/APW/Legrand/ Wipro
Light Fixture	Philips/Havells/polycab/ wipro
Lamps	Philips/ Havells/ polycab/ wipro
Ceiling Fan	Orient/Havells/Crompton Greaves/Bajaj
Exhaust Fan with louvers	Orient/Havells/Crompton Greaves/Bajaj
Geyser	Havells/ Bajaj/V-Guard/ A-O Smith/ Jaguar/ Crompton Greaves
Fire Alarm System	Notifier Honeywell/ Siemens/ Tyco/ Edwards/ Agni
Presence Detector	Hagger/Legrand/Philips
RCC Hume Pipe for Electrical Works	ISI Marked of Reputed Company
PLC	Siemens/Allen Bradley
Telephone / Co axial Wire	Polycab/finolex/Havells
Professional LED Panel	Panasonic/ Samsung/Sony
Public Address System	Honeywell/ Bosch/Tyco/Edwards
D.G. Set (Engine)	Cummins/Catterpillar/Stamford/Kirloskar
D.G. Set (Alternator)	Stamford/ LerroySommer/ Catterpillar
D.G. Accoustic Enclosure	Jakson/Sterling/CatterPiller/Sudhir
H.T. Panel	ABB/ Schneider/Siemens
H.T. Termination Kit	Raychem/Denson
Smoke Detectors	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Heat Detectors	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Manual Call Box	Notifier Honeywell/ Tyco/ Siemens

ITEM	MANUFACTURERS NAME
	Cerberus-Pro/Shrack
Hooter/ Sounder	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Response Indicator	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Fire Panel	Notifier Honeywell/ Tyco/ Siemens Cerberus-Pro/Shrack
Pa Amplifier	Honeywell/ Bosch/Heinrich/Aties
Pa Speakers	Honeywell/ Bosch/Heinrich/Aties
Line Matching Transformer	Honeywell/ Bosch/Heinrich/Aties
Goose Neck Mike	Honeywell/ Bosch/Heinrich/Aties
Inverter	Topaz International/ Luminous/ Hytes/ Su-kam/ Microtech
Camera With All Accessories	Axis / Inpulse/ Idis/ Bosch/Pelco
Road Barrier	Nice/ Magnetics/ Godrej/ GE
Card Reader	Sensormatic-Usa/ Motorola /Honeywell(Xls-3000)
Monitor	LG/ Samsung/Sony
Multiplexer	Sensormatic Or Equivalent
Sequencer	Alba/ Vantage
Proximity Card	Motorola/ Hughes/ Honeywell/GE/Siemens/Hid
Telephone Tag Block	Ctm Engg/Systimax/Schneider/Panduit
Telephone Cables	Delton / Skytone/ Clipsal/ havells
Co-Axial Cables	Finolex/ havells/ polycab
EPABX	Alkatel/ Siemens/ Nec/ Avaya/ Panasonic
CCTV System	Axis / Impulse/ Idis/ Bosch/ Honneywell /Tyco
Access Control System	Honeywell/ Siemens/Syris
Video Conference System	Polycom/Sony/Sysco
Audio Processor	Bose/Bss/Clearone
Bms Controller/Software Central Control Bms Server	Ibm/Hp/Dell
Building Management System, Building management Web Based Server Software, Programmable & Application Specifier Controller	Siemens/Honeywell Ebi/Tyco / Schneider
Sensor & Field Devices Immersion Type Temperature Sensors, Flow Meter,Ultra Sonic Thermal Energy Meter , Outside T+Rh Sensor	Siemens/Kele/Sauiter Race
Water Level Switches, Flame Proof Level Switches	Kele/ Veskler/Flipro
Dc Voltage Transducer, Current Relay	Kele/Situ/Omicron
Room Type Temp. Sensor, Co2	Siemens/Kele/Trane

ITEM	MANUFACTURERS NAME
Sensor, Ambient Temp. Sensor	
Co Sensor	Dwyer/Kale/Msr German
Pressure Transmitter	Siemens/Trane/Omicron
Differential Pressure Sensor	Siemens/Trane/Veskler
Fire Suppression System	Siemens/Kidde/Tyco
High Mast and Poles	Bajaj Electricals / My Fair Light/ Paruthi Engineering
Service/ Passenger Elevators	Kone/Schindler/OTIS

5.0 PHE WORKS

5.1 General Technical Specification of PHE Works

The General Technical Specification of PHE Works will be as per the Bill of Quantities, provision within DSR/SOR, IS Codes, Building Codes, approved drawings, Standard Norms and standard specifications of particular works.

5.2 List of Approved makes for PHE works

Acceptable makes of materials for PHE and Sanitation Materials to be used in the work are enclosed. In case of non-availability of these makes, the Contractor can use the alternative makes only BIS marked materials after approvals. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

S.NO.	ITEM	MANUFACTURERS NAME
1.	VITREOUS CHINA AND FIRECLAY SANITARYWARE WITH COVER	JAQUAR/HINDWARE/PARRYWARE/ ROCA / KOHLER / CERA
3.	STAINLESS STEEL SINKS	JAYNA/ PARRYWARE/ NEELKANTH/ NIRALI/ CERA
4.	C.P. FITTINGS & ACCESSORIES	JAQUAR/HINDWARE/PARKO/ROCA/ CERA
5.	C.P. WASTE, SPREADERS, URINAL FLUSH PIPES	JAQUAR/ HINDWARE/ PARRYWARE/ ROCA / CERA
6.	SS COCKROACH TRAPS, GRATINGS FOR FLOOR DRAINS, FLOOR TRAPS AND RAIN WATER GRATINGS	CHILLY/ JAYNA/ CAMRY
7.	SOIL, WASTE & FITTINGS (a) CENTRIFUGALLY CAST SPUN CAST IRON PIPES (IS:3989)	SKF/ NECO/BIC/ PRINCE/ SUPREME/ KISSAN
8.	RCC PIPES	PRAGATI / JAIN SPUN/ ISI MARKS OF REPUTED COMPANY
9.	PVC/ CPVC PIPES & FITTINGS	ASTRAL/ ASHIRVAD /PRINCE/ FINOLEX /PRAKASH/ SUPREME
10.	HAND DRIER	JAQUAR/ HINDWARE/EURONICS

S.NO.	ITEM	MANUFACTURERS NAME
11.	BALL VALVES	ZOLOTO/ LEADER/ AIP/ SANT / NEU-G
12	RAIN WATER PIPES & FITTINGS UPVC PIPES AND FITTINGS	PRINCE/ SUPREME/ PRAKASH/ FINOLEX/ ORI-PLAST
13.	WAFER TYPE BUTTERFLY VALVES	ZOLOTO/ LEADER/ AIP/ DANFOSS/ SANT / NEU-G
14.	WAFER TYPE NON-RETURN VALVES	ZOLOTO/ LEADER/ AIP/ DANFOSS SANT / NEU-G
15.	WATER METRES	CAPSTAN/KRANTI/KAYCEE/AQUAMET
16.	BALL COCKS	GPA/ DRP/ SANT/ L & K
17.	STONEWARE PIPES & GULLY TRAPS	PERFECT/ BURN/ RK/ SAURAKHI / MOU
18.	C.I. MANHOLES COVERS AND FRAMES	NECO/ RIF/ BIC/SKF/BIC/ RPMF
19.	RCC MANHOLE COVERS & FRAMES	KK/ PRAKASH/ JSP
20.	FASTNERS	HILTI/ INTELLOTEC / TRUCTEK / FISHER
21.	WATER HEATER	HAVELLS/ BAJAJ/ CROMPTON GREAVES
22.	HOT WATER NEOPRENE INSULATION	KAIFLEX
23.	GATE/ FULLLL WAY VALVES AND GLOBE VALVES	LEADER/ZOLOTO/SANT
24	AIR RELEASE VALVES	SANT/ LEADER/DANFOSS/ ZOLOTO
25.	PIPECOAT	IWL LIMITED/ PYPKOTE
26.	C. I. PIPE	RIF, NECO, SKF, HEPCO, BIC
27.	G. I. PIPE	JINDAL, TATA, SWASTIK, APL APOLLO, SURYA PRAKASH
28.	G.I. FITTINGS (MALLEABLE CAST IRON)	JINDAL / SURYA PRAKASH /DRP-M/ ZOLOTO-M/ UNIK
29	M.S. FITTINGS (FORGED)	DRP/ VS
30	OVERHEAD WATER TANK	SINTEX, SHEETAL, EUREWELL
31	WATER COOLER	BLUE STAR/VOLTAS/GODREJ
32	R.O WATER PURIFIER	KENT/ EUREKA FORBES/ ION EXCHANGE
33	WATER TREATMENT PLANT	ION EXCHANGE/ THERMAX/ BRISANZIA
34	HDPE PIPE	PRINCE/ SUPREME/ PRAKASH/ FINOLEX/ DUROLINE
35	DI PIPE	JINDAL/ PRINCE/ SUPREME/ PRAKASH/ FINOLEX/ JAI BALAJI
36	DI PIPE FITTINGS	JINDAL/ PRINCE/ SUPREME/ PRAKASH/ FINOLEX/ JAI BALAJI

6.0 FIRE FIGHTING WORKS

6.1 Technical Specifications of Fire Fighting works

The General Technical Specification of Fire Fighting Works will be as per the Bill of Quantities, provision within DSR/SOR, IS Codes, Building Codes, approved drawings, Standard Norms and standard specifications of particular works.

6.2 List of Approved Makes for Fire Fighting Works

Acceptable makes of materials for Fire Fighting works to be used in the work are enclosed. In case of non-availability of these makes, the Contractor can use the alternative makes only BIS marked materials after approvals. Non BIS marked materials may be permitted by the WAPCOS only when BIS marked materials are not manufactured.

S.NO.	MATERIALS	BRAND NAME
1.	M.S. PIPES	JINDAL HISSAR / PRAKASH SURYA/TATA
2.	G.I. PIPES	JINDAL HISSAR / PRAKASH SURYA/ TATA
3.	FORGED STEEL FITTINGS	DRP / SS / VS /METLINE/TRUE FORGE
4.	GUN METAL BALL VALVES	ZOLOTO / LEADER / AIP/SANT/CASTLE
5.	BUTTERFLY VALVES	ZOLOTO / LEADER / AIP/KSB/SKS
6.	NON-RETURN VALVES.	ZOLOTO / LEADER / AIP
7.	FIRE HYDRANT LANDING VALVES, FIRE BRIGADE CONNECTION (ISI MARKED)	MINIMAX / NEWAGE / FLAME GUARD
8.	OTHER VALVES	ZOLOTO / LEADER / AIP/ SANT/ KRILOSKAR / AUDCO/ SKS
9.	FIRE HOSE PIPES, FIRST AID HOSE REEL (ISI MARKED)	MINIMAX / NEWAGE / PADMINI / FLAME GUARD/MITRA
10.	BRANCH PIPE, NOZZLE AND COUPLINGS	MINIMAX / NEWAGE/ FLAME GUARD
11.	FIRE EXTINGUISHERS	MINIMAX / NEWAGE/ FLAME GUARD
12.	PUMPS	KIRLOSKAR /CROPMTON GREAVES/ MATHER + PLATT
13.	MOTORS	KIRLOSKAR / SIEMENS /CROMPTON / ABB
14.	STARTERS	GE / L & T / CONTROL & SWITCHGEAR
15.	SINGLE PHASING PREVENTOR / OVER LOAD PROTECTION UNIT	SIEMENS / MINILEC
16.	PRESSURE SWITCH	DANFOSS / SWIZER
17.	PRESSURE GAUGE	H. GURE / FIEBIG
18.	RELAYS	L & T / SIEMENS
19.	CONTRACTORS	L & T / SIEMENS
20.	CONTROL CABLE	SKYTONE / POLYCAB /

		GRANDLAY / HAVELLS
21.	ELECTRICAL PANEL	DIAMOND ELECTRICALS / SPC ELECTROTECH PVT. LTD. / NEPTUNE /
22.	MOULDED CASE CIRCUIT BREAKERS	L & T / SIEMENS / SCHNEIDER
23.	FUSE DISCONNECTOR SWITCH / SWITCH FUSE UNITS	L & T / SIEMENS / ABB / INDO ASIAN SCHNEIDER / POLYCAB/ control & SWITCH GEAR.
24.	HRC FUSES	L & T / SIEMENS / SCHNEIDER
25.	AMMETER, VOLTMETER	UNIVERSAL
26.	SELECTOR SWITCH, PUSH BUTTON SWITCH / EMERGENCY SWITCH	L & T /SIEMENS / SCHNEIDER
27.	1.1 KV LT CABLES (ISI MARKED)	FINOLEX / POLYCAB / HAVELLS
28.	PIPE COAT	IWL LIMITED / STP / PYPKOTE
29.	FASTENERS	HILTI / INTELLOTECH/ FISHER/ TRUTEK
30.	SUSPENDERS	INTELLOTECH / CAMRY

7.0 Submission of Samples:

The contractor shall submit to the Engineer-in-Charge samples of all materials for approval and no work shall commence before such samples are duly approved. Samples of precast concrete panels, masonry units, building insulation, finished hardware, metal window and door frames, kota stone, marble etc. and every other work requiring samples in the opinion of the Engineer-in-Charge shall be supplied to the Engineer-in-Charge, and these samples will be retained as standards of materials and workmanship. The cost of the samples shall be borne by the contractor.

Throughout this specification, types of material may be specified by manufacturers' name in order to establish standard of quality, price and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the tenderers may assume the price of approved equivalent' except that the burden is upon the contractor to prove such equality, in writing.

8.0 Tests :

All materials and methods of tests shall conform to the latest rules, regulation and/or specifications of the following authorities where specified herein as applicable. Bureau of Indian Standards (BIS), British Standards Code of Practice (BS) in case no equivalent BIS is available.

The Engineer-in-Charge will have the option to have any of the materials tested and if the test results show that the materials do not conform to the specifications, such materials shall be rejected. A reasonable number of representative tests will be deemed to be included in the rates tendered.

9.0 NOTE ABOUT INCONSISTENCY

The work specified in the tender will be executed as per Detailed Specification of Works, General Technical Specifications, Approved Drawings and CPWD standards & methodology. In case of any inconsistency about the "Type of Item(s) which are to be executed" between Detailed Specification of Works, General Technical Specifications, Approved Drawings and CPWD standards & methodology, the contents of following will be the order of priority.

1. Detailed Specifications of works.
2. Approved Drawings
3. General Technical Specifications
4. CPWD standards & methodology

Note:

- The contractor must aware about the location of proposed works, surrounding local condition where works are to be constructed, Encroachment by local people and its consequence which may affect the progress of works. Accordingly, shall submit BID considering all these aspect and shall quote the rates. Contractor shall not raise any extra/additional claim on these aspects.

- The contractor is required to deploy the resources at site and start the construction. No claim shall be entertained for idle labour, idle machinery, idle technical/non-technical staff, idle T&P and if any hindrance due to any reason.

- If any dispute/hindrance may arise during construction, the contractor is not liable for any financial claim for damages to such circumstances.

- The bidder shall be responsible right through the entire duration of the Project for execution of all works till commissioning and handing over of project complete with all respects and shall remove all defects, if any, developed during defect liability period (DLP).

- The work shall be executed as per the scope of work, drawings and direction of Engineer-in-Charge and shall be completed in all respect with full satisfaction of Engineer-in-charge as per the Government Guidelines, Indian Standard codes & Manuals. The bidder may assess the quantum of work before filling of tender.

- Contractor will also submit report on completed work along with drawings of completed (As-built Drawings) work and including photographs of works.

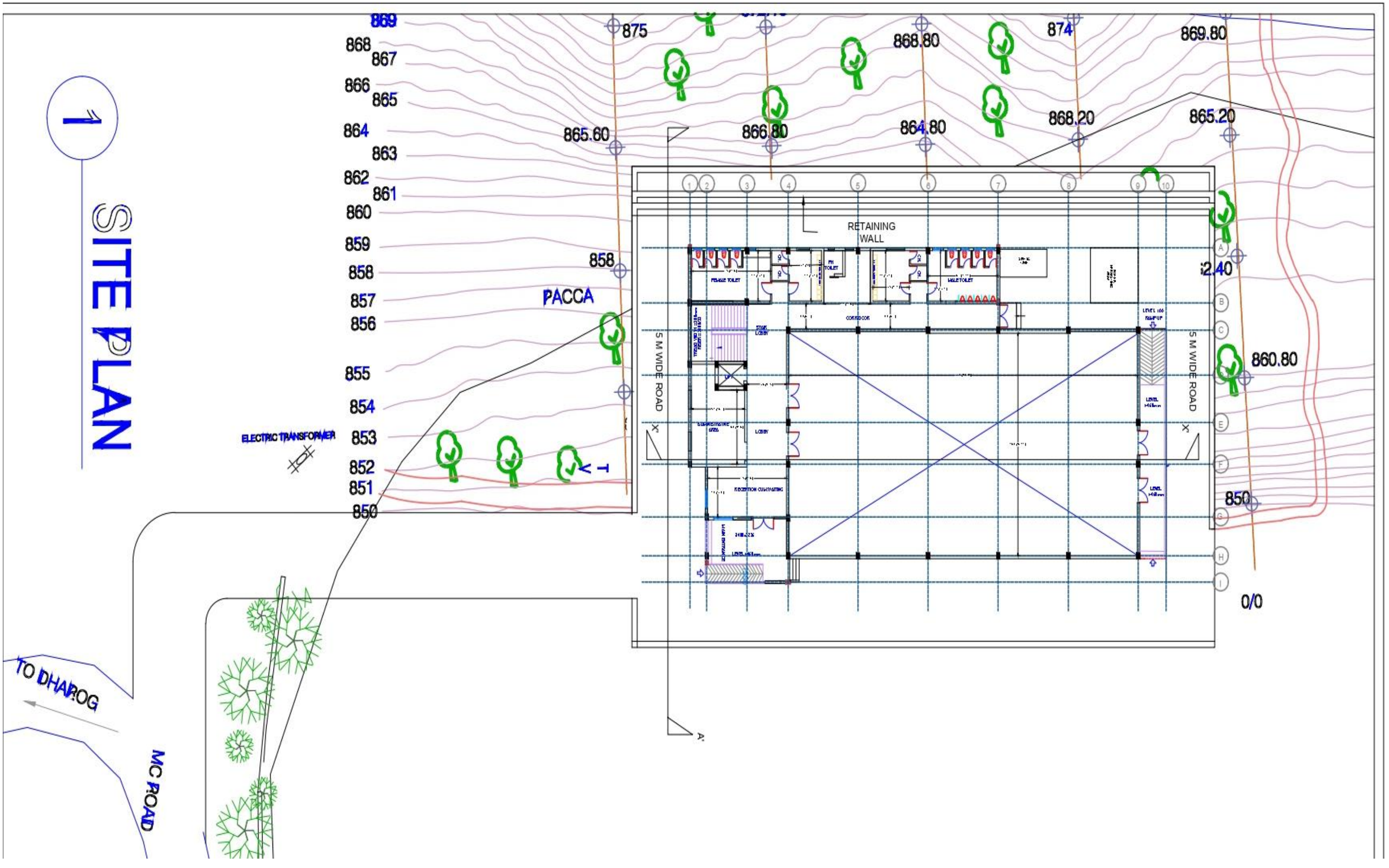
- Contactor will take necessary approvals/clearance from the concerned department before start the work.

- The contractor will submit the sample and test reports of prefab panel, paints, steel, cement, coarse sand, stone etc. to the Engineer-In-charge for approval before starting the work.

- Any material used without prior approval shall be replaced by the Contractor immediately at its his own cost. No payment in this regard shall be entertained.
- The contractor shall make its own arrangements for obtaining electric and water connection/arrangement.
- The contractor shall dispose of all the dismantled material, debris, garbage, waste, outside of the campus of the works at his own cost after prior approval from Engineer-in-charge and provide clear and clean site at the time of handing over the works.

SECTION – VIII

TENDER DRAWINGS OF THE PROJECT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SITE PLAN
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PACCA
ELECTRIC TRANSFORMER
RETAINING WALL
5 M WIDE ROAD
860.80
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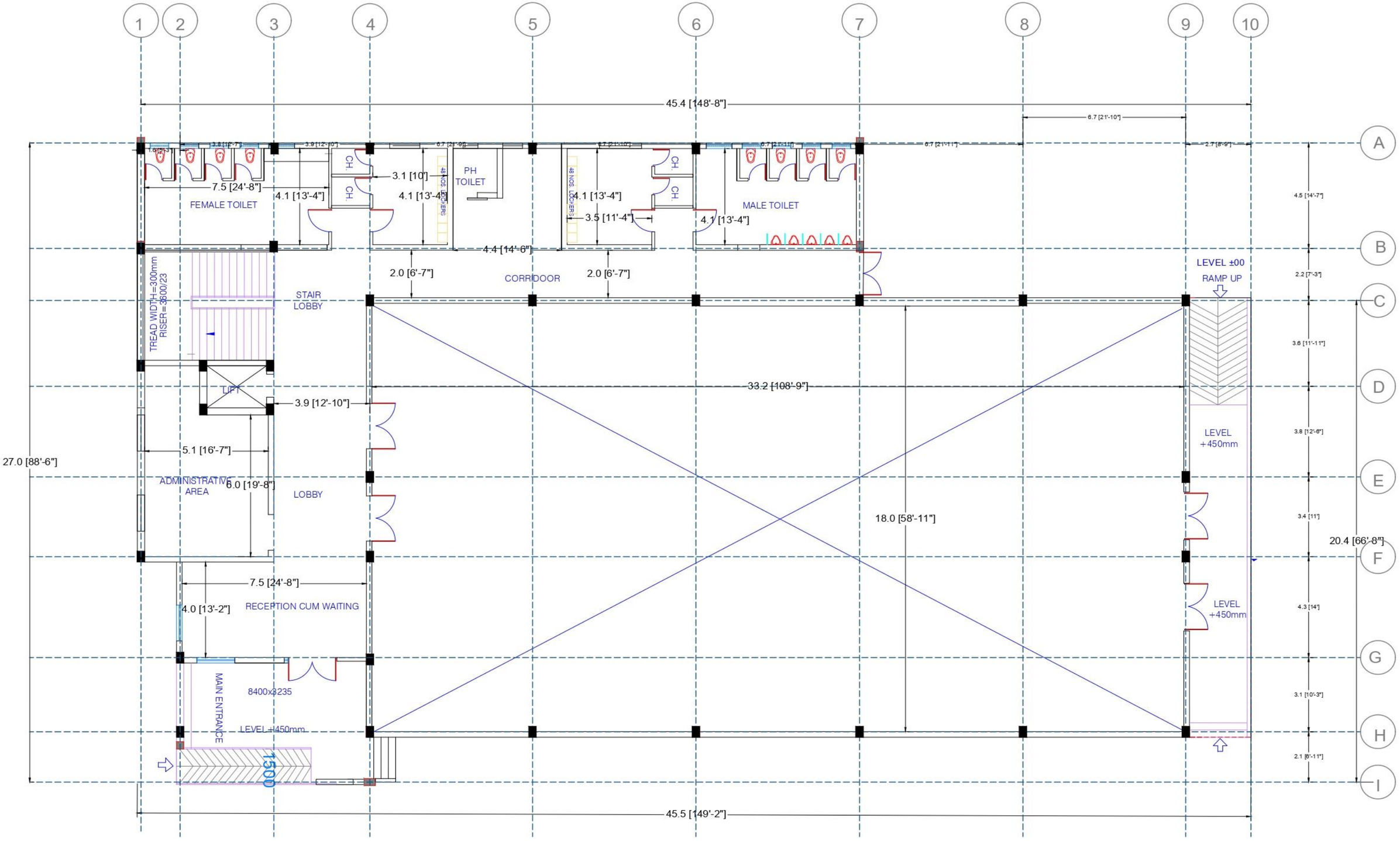
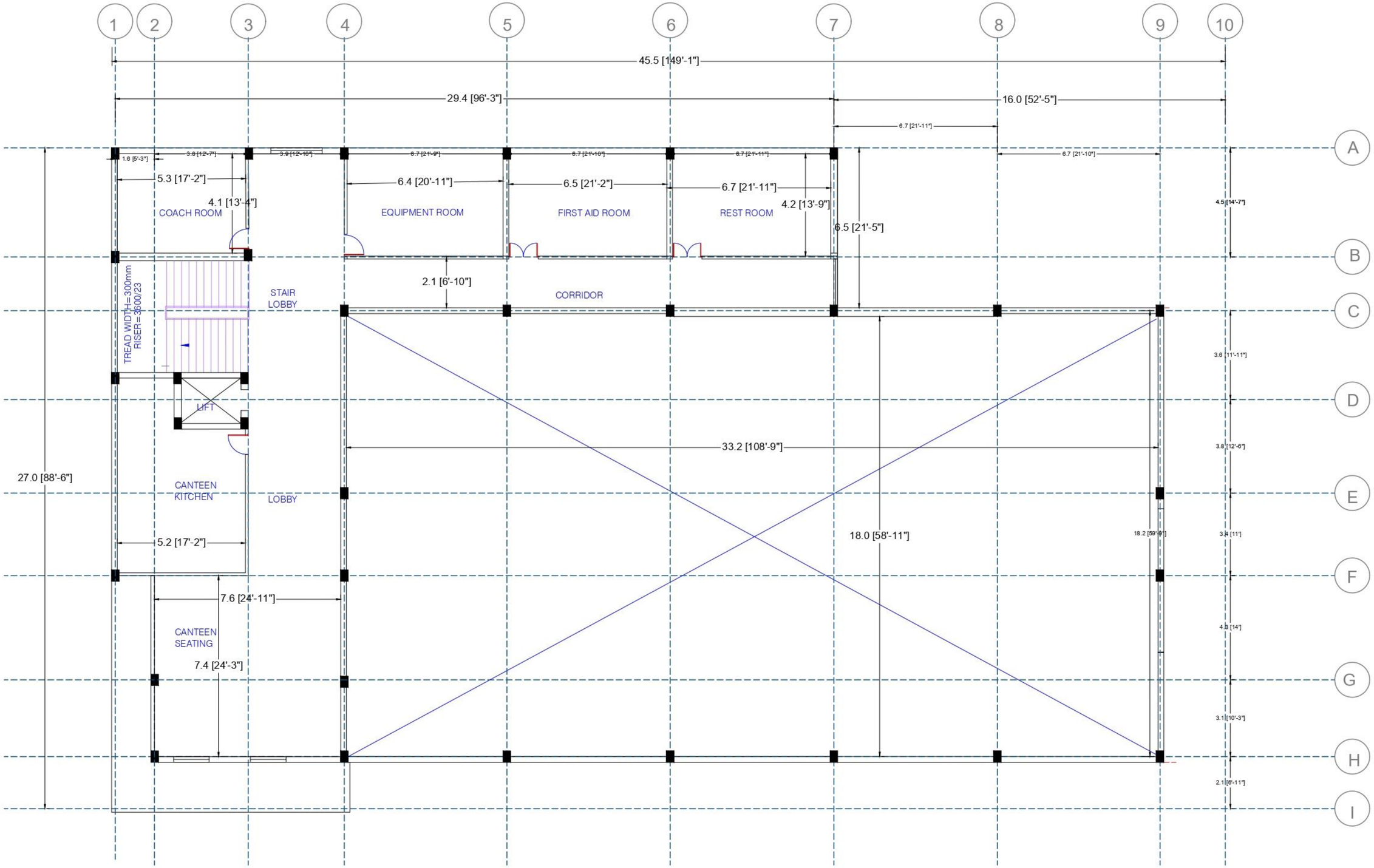
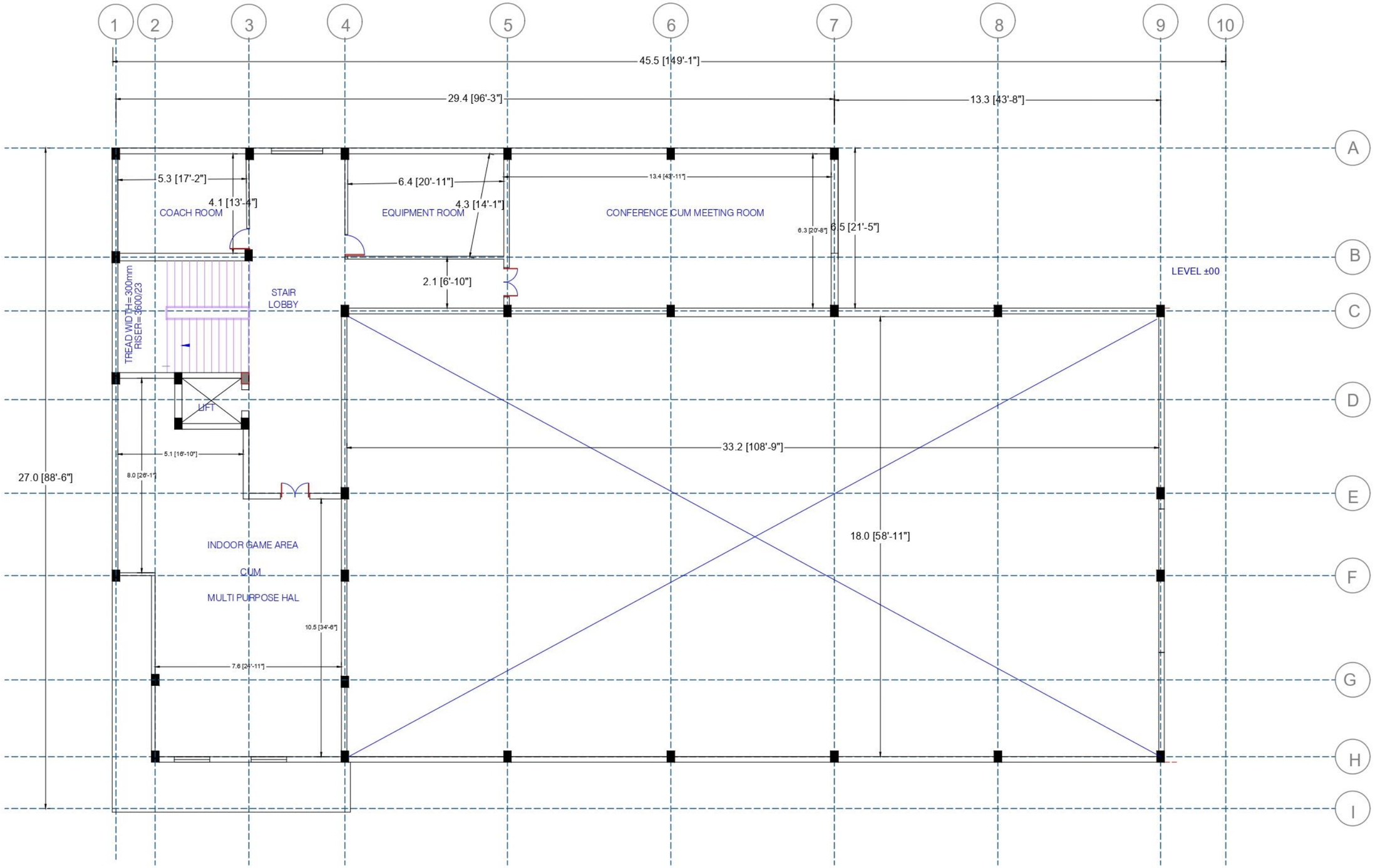
TO DHAROG
MC ROAD



GROUND FLOOR PLAN

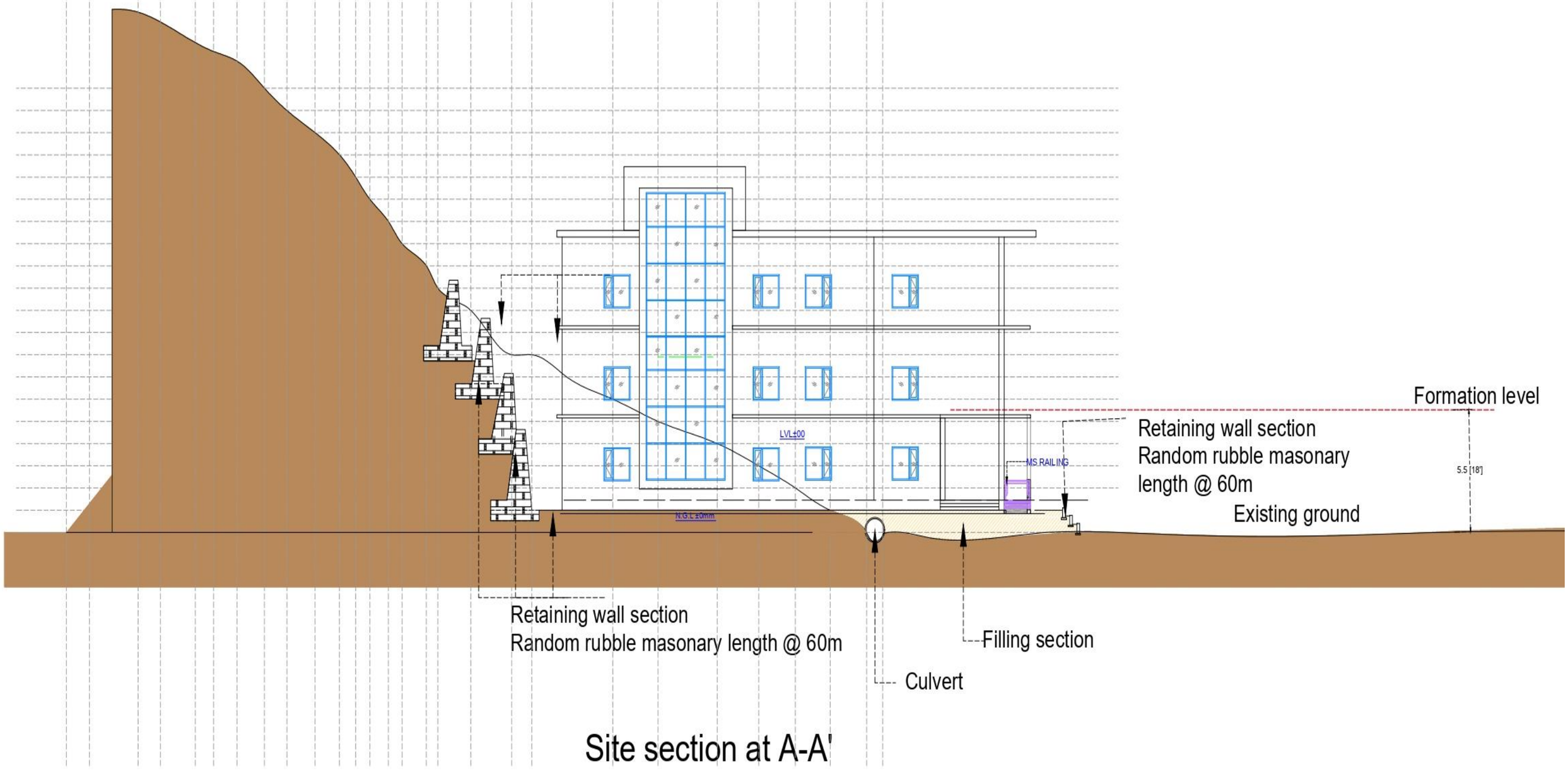


FIRST FLOOR PLAN

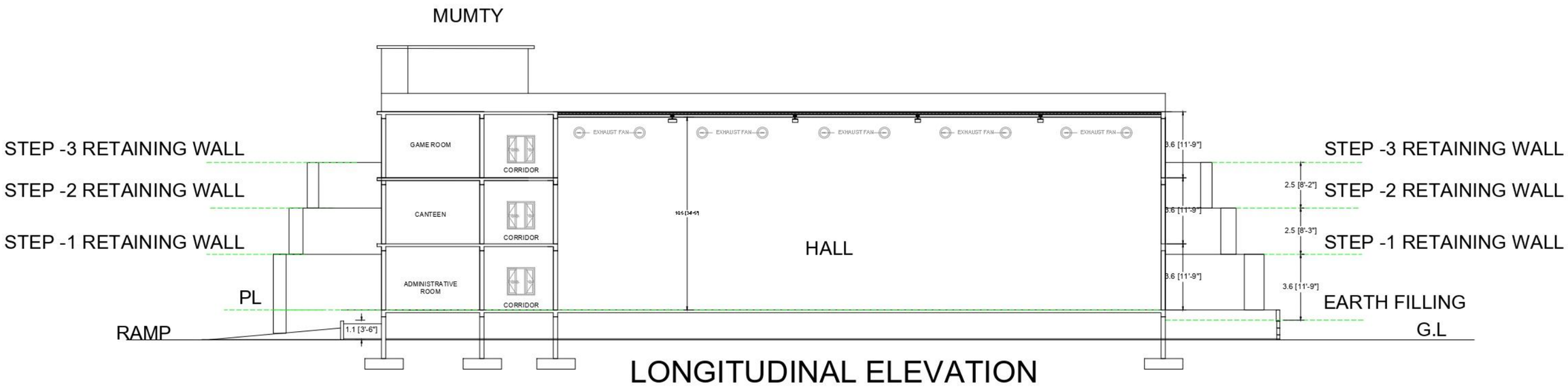


2ND FLOOR PLAN

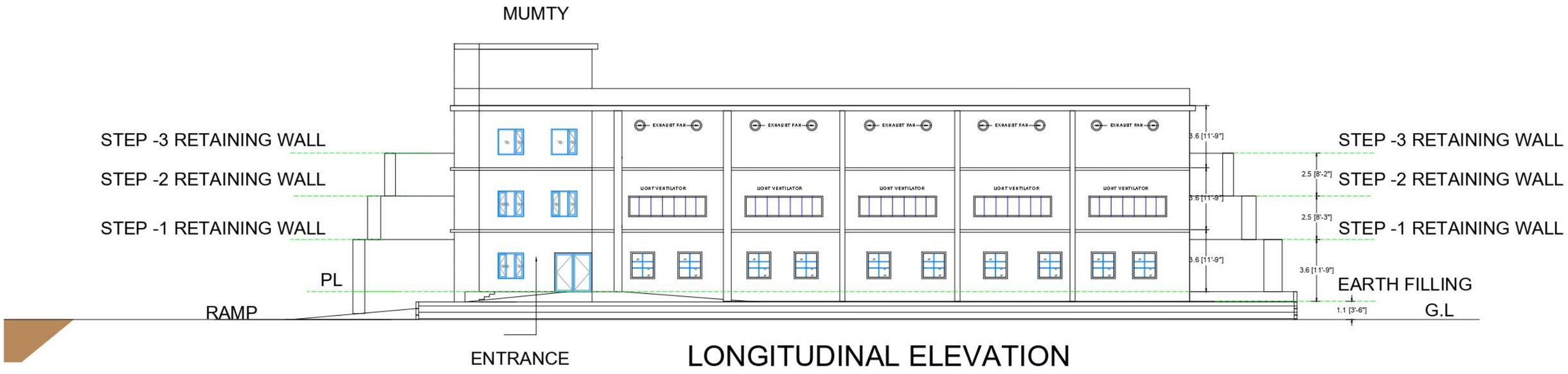
cutting section in length @60m



Site section at A-A'



LONGITUDINAL ELEVATION



LONGITUDINAL ELEVATION

SECTION – IX

TECHNICAL SPECIFICATIONS

SPECIFICATIONS

1.1 GENERAL

The rates for all items of work unless clearly specified otherwise shall include cost of all labour, materials and other inputs involved in the execution of the items.

1.2 INTERPRETATIONS

Wherever any reference is made to any Indian Standard, it shall be taken as reference to the latest edition with all amendments issued thereto. In the event of any variation between the CPWD specifications and the Indian Standard, the former shall take precedence over the latter.

1.3 MEASUREMENTS

1.3.1 In booking dimensions, the order shall be consistent and in the sequence of length, width and height or depth or thickness.

1.3.2 Rounding off: Rounding off where required shall be done in accordance with IS: 2-1960. The number of significant places rounded in the rounded off value should be as specified.

1.4 MATERIALS

1.4.1 Samples of all materials to be used on the work shall be got approved by the contractor from the Engineer-in-Charge well in time. All materials to be provided by the contractor shall be brand new and as per the samples approved by the Engineer-in-Charge.

1.4.2 Materials obtained by the contractor from the shall be subjected to the Mandatory tests. Where such materials do not conform to the relevant specifications, the matter shall be taken up by the Engineer-in-Charge for appropriate action against the defaulters. In all such cases, necessary documents in original and proof of payment relating to the procurement of materials shall be made available by the contractor to the Engineer-in-Charge.

1.4.3 Samples, whether submitted for approval to govern bulk supplies or required for testing before use and also the sample of materials bearing ‗Standard mark,' if required for testing, shall be provided free of cost by the contractor. All other incidental expenditure to be incurred for testing of samples e.g. packaging, sealing transportation, loading, unloading etc. and testing charges shall be borne by the contractor.

1.4.4 The materials, supplied by the contractor shall be deemed to be complying with the specifications.

1.4.5 Materials stored at site, depending upon the individual characteristics, shall be protected from atmospheric effects due to rain, sun, wind and moisture to avoid deterioration.

1.4.6 Materials like timber, paints etc. shall be stored in such a way that there may not be any possibility of fire hazards. Inflammable materials and explosives shall be stored in accordance with the relevant rules and regulations so as to ensure desired safety during storage.

1.4.7 The unit weight of materials unless otherwise specified shall be reckoned as given in IS: 1911-1967.

1.5 SAFETY IN CONSTRUCTION

1.5.1 The contractor shall employ only such methods of construction, tools and plant as are appropriate for the type of work or as approved by Engineer-in-Charge in writing.

1.5.2 The contractor shall take all precautions and measures to ensure safety of works and workman and shall be fully responsible for the same. Safety pertaining to construction works such as excavation, centering and shuttering, trenching, blasting, demolition, electric connections, scaffolds, ladders, working platforms, gangway, mixing of bituminous materials, electric and gas welding, use of hoisting and construction machinery shall be governed by CPWD safety code, relevant safety codes and the direction of Engineer-in-Charge

1.6 ABBREVIATIONS

The following abbreviations wherever they appear in the specifications, shall have the meaning or implication hereby assigned to them:

Mm	Millimetre
Cm	Centimetre
M	Metre
Km	Kilometre
Mm2/sqmm	Square Milimetre
Cm2/sqcm	Square centimetre
Dm2/sqdm	Square decimetre
M2/sqm	Square metre
Cm3/ cubic cm	Cubic centimetre
Dm3/ cubic dm	Cubic decimetre
M3/cum	Cubic metre
Ml	Millilitre
Kl	Kilolitre
Gm	Gram
Kg	Kilogram
Q	Quintal
T	Tonne
Fps system	Foot pound second system

°C	Degree Celsius temperature
Fig	Figure
Re/Rs	Rupee/ Rupees
No	Number
Dia	Diameter
AC	Asbestos cement
CI	Cast Iron
GC	Galvanised corrugated
GP	Galvanised plain
GI	Galvanised iron
PVC	Polyvenyl chloride
RCC	Reinforced cement concrete
SW	Stone ware
SWG	Standard wire Gauge

1.7 CARRIAGE OF MATERIALS

The carriage and stacking of materials shall be done as per CPWD specification or as directed by the Engineer-in-Charge. Any tools and plants, required for the work shall be arranged by the Contractor

1.7.1 RESPONSIBILITY FOR LOSS OR DAMAGE

Loading, carriage, unloading and stacking shall be done carefully to avoid loss or damage to the materials

1.8 LEAD

1.8.1 Route other than shortest practical route may be considered in cases of unavoidable circumstances and as approved by Engineer-in-Charge along with reasons in writing.

1.8.2 Carriage by manual labour shall be reckoned in units of 50 metres or part thereof.

1.8.3 Carriage by animal and mechanical transport shall be reckoned in one km unit. Distances of 0.5 km or more shall be taken as 1 km and distance of less than 0.5 km shall be ignored.

2.1 Earth Work: List of Bureau of Indian Standard Codes

S. No.	I.S. Codes	Subject
1	IS 632	Gamma – BHC (Lindane) emulsifiable concentrates
2	IS 1200 (Pt 1)	Method of measurement of earth work
3	IS 1200 (Pt-27)	Method of measurement of earth work (by Mechanical Appliances)
4	IS 4081	Safety code for Blasting and related drilling operation
5	IS 4988 (Part IV)	Excavators
6	IS 6313 (pt-II)	Anti-Termite measures in buildings (pre -constructional)
7	IS 12138	Earth moving Equipments

2.2 CLASSIFICATION OF SOILS

The earthwork shall be classified under the following categories and measured separately for each category:

(a) All kind of soils: Generally any strata, such as sand, gravel, loam, clay, mud, black cotton moorum, shingle, river or nallah bed boulders, siding of roads, paths etc. and hard core, macadam surface of any description (water bound, grouted tarmac etc.), lime concrete mud concrete and their mixtures which for excavation yields to application of picks, shovels, jumper, sacrifiers, ripper and other manual digging implements.

(b) Ordinary rock: Generally any rock which can be excavated by splitting with crow bars or pick and does not require blasting, wedging or similar means for excavation such as lime stone, san stone, hard laterite, hard conglomerate and un-reinforced cement concrete below ground level If required light blasting may be resorted to for loosening the materials but this will not in any way entitle the material to be classified as ‗Hard rock'.

(c) Hard rock: Generally any rock or boulder for the excavation of which blasting is required such as quartzite, granite, basalt, reinforced cement concrete (reinforcement to be cut through but not separated from concrete) below ground level and the like.

(d) Hard rock (blasting prohibited): Hard rock requiring blasting as described under

(c) But where the blasting is prohibited for any reason and excavation has to be carried out by chiseling, wedging, use of rock hammers and cutters or any other agreed method.

2.3 PROTECTIONS

2.3.1 Excavation shall be securely barricaded and provided with proper caution signs, conspicuously displayed during the day and properly illuminated with red lights and/or written using fluorescent reflective paint during the night to avoid accident.

2.3.2 The Contractor shall take adequate protective measures to see that the excavation operations do not damage the adjoining structures or dislocate the services.

No damage to the Existing structures and services such as old buildings, culverts, fencing, water supply pipe lines, sewers, power cables, communication cables, drainage pipes etc. within or adjacent to the area is envisaged However, if any service is damaged during excavation shall be restored in reasonable time.

2.3.3 Excavation shall not be carried out below the foundation level of the adjacent buildings.

2.3.4 Any damages done by the contractor to any existing work shall be made good by him at his own cost.

2.4 SITE CLEARANCE

2.4.1 Before the earth work is started, the area coming under cutting and filling shall be cleared of shrubs, rank vegetation, grass, brushwood, trees and saplings of girth up to 30cm measured at a height of one metre above ground level and rubbish removed up to a distance of 50 metres outside the periphery of the area under clearance. The roots of trees and saplings shall be removed to a depth of 60cm below ground level or 30 cm below formation level or 15 cm below sub grade level, whichever is lower, and the holes or hollows filled up with the earth, rammed and levelled.

2.4.2 The trees of girth above 30 cm measured at a height of one metre above ground shall be retained

2.4.3 Lead of 50 m mentioned in the 'Schedule of Quantities' is the average lead for the disposal of excavated earth within the site of work.

2.4.4 Disposal of Earth shall be disposed of at the specified location.

2.5 SETTING OUT AND MAKING PROFILES

2.5.1 A masonry pillar to serve as a bench mark will be erected at a suitable point in the area, which is visible from the largest area. This bench mark shall be constructed and connected with the standard bench mark. Necessary profiles with strings stretched on pegs, bamboos or Burjis shall be made to indicate the correct formation levels before the work is started. The pegs, bamboos or Burjis and the bench mark shall be maintained during the excavation to check the profiles.

2.5.2 The ground levels shall be taken at 5 to 15 metres intervals (as directed by the Engineer-in-Charge) in uniformly sloping ground and at closer intervals where local mounds, pits or undulations are met with. The ground levels shall be recorded in field books and plotted on plans.

2.6 BLASTING

2.6.1 Where hard rock is met with and blasting operations are considered necessary, the contractor shall obtain the approval of the Engineer-in-Charge in writing for resorting to blasting operation.

Note: In ordinary rock blasting operations shall not be generally adopted. However, the contractor may resort to blasting with the permission of the Engineer-in-charge, but nothing extra shall be paid for such blasting operations.

The contractor shall obtain license from the competent authority for undertaking blasting work as well as for obtaining and storing the explosive as per the Explosive Act, 1884 as amended up to date and the Explosive Rules, 1983. The contractor shall purchase the explosives fuses, detonators, etc. only from a licensed dealer. The contractor shall be responsible for the safe transportation, storage and custody as

per explosive rules and proper accounting of the explosive materials. Fuses and detonators shall be stored separately and away from the explosives. The Engineer-in-Charge or his authorized representative shall have the right to check the contractor‘s store and account of explosives. The contractor shall provide necessary facilities for this.

The contractor shall be responsible for any damage arising out of accident to workmen, public or property due to storage, transportation and use of explosive during blasting operation.

2.6.2 Blasting operations shall be carried out under the supervision of a responsible authorized agent of the contractor (referred subsequently as agent only), during specified hours as approved in writing by the Engineer-in-Charge. The agent shall be conversant with the rules of blasting. In case of blasting with dynamite or any other high explosive, the position of all the bore holes to be drilled shall be marked in circles with white paint. These shall be inspected by the contractor‘s agent. Bore holes shall be of a size that the cartridge can easily pass down. After the drilling operation, the agent shall inspect the holes to ensure that drilling has been done only at the marked locations and no extra hole has been drilled. The agent shall then prepare the necessary charge separately for each bore hole. The bore holes shall be thoroughly cleaned before a cartridge is inserted. Only cylindrical wooden tamping rods shall be used for tamping. Metal rods or rods having pointed ends shall never be used for tamping. One cartridge shall be placed in the bore hole and gently pressed but not rammed down. Other cartridges shall then be added as may be required to make up the necessary charge for the bore hole. The top most cartridge shall be connected to the detonator which shall in turn be connected to the safety fuses of required length. All fuses shall be cut to the length required before being inserted into the holes. Joints in fuses shall be avoided. Where joints are unavoidable a semi-circular nitch shall be cut in one piece of fuse about 2 cm deep from the end and the end of other piece inserted into the nitch. The two pieces shall then be wrapped together with string. All joints exposed to dampness shall be wrapped with rubber tape. The maximum of eight bore holes shall be loaded and fired at one occasion. The charges shall be fired successively and not simultaneously. Immediately before firing, warning shall be given and the agent shall see that all persons have retired to a place of safety. The safety fuses of the charged holes shall be ignited in the presence of the agent, who shall see that all the fuses are properly ignited. Careful count shall be kept by the agent and others of each blast as it explodes. In case all the charged bore holes have exploded, the agent shall inspect the site soon after the blast but in case of misfire the agent shall inspect the site after half an hour and mark red crosses (X) over the holes which have not exploded. During this interval of half an hour, nobody shall approach the misfired holes. No driller shall work near such bore

until either of the following operations have been done by the agent for the misfired boreholes.

(a) The contractor‘s agent shall very carefully (when the tamping is of damp clay) extract the tamping with a wooden scraper and withdraw the fuse, primer and detonator. After this a fresh detonator, primer and fuse shall be placed in the misfired holes and fired, or

(b) The holes shall be cleaned for 30 cm of tamping and its direction ascertained by placing a stick in the hole. Another hole shall then be drilled 15 cm away and parallel to it. This hole shall be charged and fired. The misfired holes shall also explode along with the new one. Before leaving the site of work, the agent of one shift shall inform the agent relieving him for the next shift, of any case of misfire and each such location shall be jointly inspected and the action to be taken in the matter shall be explained to the relieving agent. The Engineer-in-Charge shall also be informed by the agent of all cases of misfires, their causes and steps taken in that connection.

2.6.3 General Precautions

For the safety of persons red flags shall be prominently displayed around the area where blasting operations are to be carried out. All the workers at site, except those who actually ignite the fuse, shall withdraw to a safe distance of at least 200 metres from the blasting site. Audio warning by blowing whistle shall be given before igniting the fuse. Blasting work shall be done under careful supervision and trained personnel shall be employed. Blasting shall not be done within 200 metres of an existing structure, unless specifically permitted by the Engineer-in-Charge in writing. All procedures and safety precautions for the use of explosives drilling and loading of explosives drilling and loading of explosives before and after shot firing and disposal of explosives shall be taken by the contractor as detailed in IS 4081, safety code for blasting and related drilling operation.

2.6.4 Precautions against Misfire

The safety fuse shall be cut in an oblique direction with a knife. All saw dust shall be cleared from inside of the detonator. This can be done by blowing down the detonator and tapping the open end. No tools shall be inserted into the detonator for this purpose.

If there is water present or if the bore hole is damp, the junction of the fuse and detonator shall be made water tight by means of tough grease or any other suitable material. The detonator shall be inserted into the cartridge so that about one third of the copper tube is left exposed outside the explosive. The safety fuse just above the

detonator shall be securely tied in position in the cartridge. Water proof fuse only shall be used in the damp bore hole or when water is present in the bore hole.

If a misfire has been found to be due to defective fuse, detonator or dynamite, the entire consignment from which the fuse detonator or dynamite was taken shall be got inspected by the Engineer-in-Charge or his authorized representative before resuming the blasting or returning the consignment.

2.7 EXCAVATION IN ALL KINDS OF SOILS

2.7.1 All excavation operations manually or by mechanical means shall include excavation and getting out the excavated materials. In case of excavation for trenches, basements, water tanks etc. getting out shall include throwing the excavated materials at a distance of at least one metre or half the depth of excavation, whichever is more, clear off the edge of excavation. In all other cases 'getting out' shall include depositing the excavated materials as specified. The subsequent disposal of the excavated material shall be either stated as a separate item or included with the items of excavation stating lead.

2.7.2 During the excavation the natural drainage of the area shall be maintained. Excavation shall be done from top to bottom. Undermining or undercutting shall not be done.

2.7.3 In firm soils, the sides of the trenches shall be kept vertical up to a depth of 2 metres from the bottom. For greater depths, the excavation profiles shall be widened by allowing steps of 50 cms on either side after every 2 metres from the bottom. Alternatively, the excavation can be done so as to give slope of 1:4 (1 horizontal: 4 vertical). Where the soil is soft, loose or slushy, the width of steps shall be suitably increased or sides sloped or the soil shored up as directed by the Engineer-in-Charge. It shall be the responsibility of the contractor to take complete instructions in writing from the Engineer-in-Charge regarding the stepping, sloping or shoring to be done for excavation deeper than 2 metres.

2.7.4 The excavation shall be done true to levels, slope, shape and pattern indicated by the Engineer-in-Charge.

2.7.5 In case of excavation for foundation in trenches or over areas, the bed of excavation shall be to the correct level or slope and consolidated by watering and ramming. If the excavation for foundation is done to a depth greater than that shown in the drawings or as required by the Engineer-in-Charge, the excess depth shall be made good by the contractor at his own cost with the concrete of the mix used for levelling/ bed concrete for foundations.

2.7.6 While carrying out the excavation for drain work care shall be taken to cut the side and bottom to the required shape, slope and gradient. The surface shall then be properly dressed. If the excavation is done to a depth greater than that shown on the drawing or as required by the Engineer-in-Charge, the excess depth shall be made good by the contractor at his own cost with stiff clay puddle at places where the drains are required to be pitched and with ordinary earth, properly watered and rammed, where the drains are not required to be pitched. In case the drain is required is to be pitched, the back filling with clay puddle, if required, shall be done simultaneously as the pitching work proceeds. The brick pitched storm water drains should be avoided as far as possible in filled-up areas and loose soils.

2.7.7 In all other cases where the excavation is taken deeper by the contractor, it shall be brought to the required level by the contractor at his own cost by filling in with earth duly watered, consolidated and rammed.

2.7.8 In case the excavation is done wider than that shown on the drawings or as required by the Engineer-in-Charge, additional filling wherever required on the account shall be done by the contractor at his own cost.

2.7.9 The excavation shall be done manually or by mechanical means as directed by Engineer-in-charge considering feasibility, urgency of work, availability of labour /mechanical equipment and other factors involved.

2.8 FILLING

2.8.1 The earth used for filling shall be free from all roots, grass, shrubs, rank vegetation, brushwood, tress, sapling and rubbish.

2.8.2 Filling with excavated earth shall be done in regular horizontal layers each not exceeding 20 cm in depth. All lumps and clods exceeding 8 cm in any direction shall be broken. Each layer shall be watered and consolidated with steel rammer or ½ tonne roller. Where specified, every third and top must layer shall also be consolidated with power roller of minimum 8 tonnes. Wherever depth of filling exceeds 1.5 metre vibratory power roller shall be used to consolidate the filing unless otherwise directed by Engineer-in-charge. The top and sides of filling shall be neatly dressed. The contractor shall make good all subsidence and shrinkage in earth fillings, embankments, traverses etc. during execution and till the completion of work unless otherwise specified.

2.9 EXCAVATION IN TRENCHES FOR PIPES, CABLES ETC. AND REFILLING

This shall comprise excavation not exceeding 1.5 mts in width or 10 sqm in plan and to any depth trenches for pipes. Cables etc. and returning the excavated material to

fill the trenches after pipes, cables etc. are laid and their joints tested and passed and disposal of surplus excavated material upto 50 m lead.

2.10 PLANKING AND STRUTTING

When the depth of trench in soft/loose soil exceeds 2 metres, stepping, sloping and/ or planking and strutting of sides shall be done. In case of loose and slushy soils, the depths at which these precautions are to be taken shall be determined by the Engineer-in-Charge according to the nature of soil.

Planking and strutting shall be close or open depending on the nature of soil and the depth of trench. The type of planking and strutting shall be determined by the Engineer-in-Charge. It shall be the responsibility of the contractor to take all necessary steps to prevent the sides of trenches from collapse. Engineer-in-Charge should take guidance from IS: 3764 for designing the shoring and strutting arrangements and specifying the profile of excavation.

2.11 EXCAVATION IN WATER. MUD OR FOUL POSITION

2.11.1 All water that may accumulate in excavations during the progress of the work from springs, tidal or river seepage, broken water mains or drains (not due to the negligence of the contractor), and seepage from subsoil aquifer shall be bailed, pumped out or otherwise removed. The contractor shall take adequate measures for bailing and/or pumping out water from excavations and/or pumping out water from excavations and construct diversion channels, bunds, sumps, coffer dams etc. as may be required. Pumping shall be done directly from the foundation trenches or from a sump outside the excavation in such a manner as to preclude the possibility of movement of water through any fresh concrete or masonry and washing away parts of concrete or mortar. During laying of concrete or masonry and for a period of at least 24 hours thereafter, pumping shall be done from a suitable sump separated from concrete or masonry by effective means.

Capacity and number of pumps, location at which the pumps are to be installed, pumping hours etc. shall be decided from time to time. Pumping shall be done in such a way as not to cause damage to the work or adjoining property by subsidence etc. Disposal of water shall not cause inconvenience or nuisance in the area or cause damage to the property and structure nearby. To prevent slipping of sides, planking and strutting may also be done

2.11.2 Work in or under foul position: Excavation, where sewage, sewage gases or foul conditions are met with from any source, shall fall in this category. Decision of the Engineer-in-Charge whether the work is in foul position or not shall be final.

2.12 EARTH WORK FOR MAJOR WORKS

2.12.1 Excavation shall be undertaken to the width of the Retaining wall/pile foundation footing including necessary margins for construction operation as per drawing or directed otherwise.

Where the nature of soil or the depth of the trench and season of the year, do not permit vertical sides, the contractor at his own expense shall put up the necessary shoring, strutting and planking or cut slopes with or without steps, to a safer angle or both with due regard to the safety of personnel and works and to the satisfaction of the Engineer. Measurement of plan area of excavation for payment shall be permitted.

2.12.2 All the major excavation shall be carried out by mechanical excavator

2.12.3 The contractor shall make at his own cost all necessary arrangements for maintaining water level, in the area where works are under execution low enough so as not to cause any harm to the work shall be considered as inclusive of pumping out or bailing out water, if required, for which no extra payment shall be made. This will include water coming from any source, such as rains, accumulated rain water, floods, leakages from sewer and water mains, subsoil water table being high or due to any other cause whatsoever. The contractor shall make necessary provision of pumping, dredging bailing out water coming from all above sources and excavation and other works shall be kept free of water by providing suitable system approved by the Engineer-in-charge.

2.12.4 The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades including signs, markings, flags, lights and flagman, as necessary at either end of the excavation/embankment and at such intermediate points as directed by the Engineer-in-charge for the proper identification of construction area. He shall be responsible for all damages and accidents caused due to negligence on his part.

2.12.5 The contractor shall provide suitable barricading with suitably painted single row of G.I. Sheets about 3‘- 0‖ wide (90 cms.) nailed or bolted with wooden poles spaced 2 to 3 metre apart and each pole 1.6 m to 2 m long 8 cm. to 10 cm. dia. The poles will be embedded in mobile iron pedestal rings suitably framed for giving stable support as per direction of the Engineer-in-charge. All management (including watch and ward) of barricades shall be the full responsibility of the contractor. The barricades shall be removed only after completion of the work or part of the work. The contractor‘s rate shall include all above items of work and nothing extra shall be paid to the contractor over and above his quoted rates.

2.13 FILLING IN TRENCHES, PLINTH, UNDER FLOOR ETC.

2.13.1 Earth

Normally excavated earth from same area shall be used for filling. Earth used for filling shall be free from shrubs, rank, vegetation, grass, brushwood, stone shingle and boulders (larger than 75mm in any direction), organic or any other foreign matter. Earth containing deleterious materials, salt peter earth etc. shall not be used for filling. All clods and lumps of earth exceeding 8 cm in any direction shall be broken or removed before the earth is used for filling.

2.13.2 Filling

The space around the foundations and drains in trenches shall be cleared of all debris, brick bats etc. The filling shall be done in layers not exceeding 20 cm in depth. Each layer shall be watered, rammed and consolidated. Ramming shall be done with iron rammers where possible and with blunt end of crow bars where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches. In case of filling under floor, the finished level of filling shall be kept to the slope intended to be given to the floor.

2.14 SAND FILLING IN PLINTH

2.14.1 Sand

Sand shall be clean and free from dust organic and foreign matter and its grading shall be within the limits of grading zone IV or V specified in Section 3 'Mortars'.

2.14.2 Filling

Sand filling shall be done in a manner similar to earth filling in plinth specified in 2.23.3.2. Except that consolidation shall be done by flooding with water. The surface of the consolidated sand filling shall be dressed to the required level or slope and shall not be covered till the Engineer-in-Charge has inspected and approved the sand filling.

2.15 SURFACE DRESSING.

Surface dressing shall include cutting and filling up to a depth of 15 cm and clearing of shrubs, rank vegetation, grass, brushwood, trees and saplings of girth up to 30 cm measured at a height of one metre above the ground level and removal of rubbish and other excavated material up to a distance of 50 metres outside the periphery of the area under surface dressing. High portions of the ground shall be cut down and hollows depression filled up to the required level with the excavated earth so as to give an even, neat and tidy look.

2.16 JUNGLE CLEARANCE

Jungle clearance shall comprise uprooting of rank vegetation, grass, brushwood, shrubs, stumps, trees and saplings of girth upto 30 cm measured at a height of one

metre above the ground level. Where only clearance of grass is involved it shall be measured and paid for separately.

2.16.1 Uprooting of Vegetation

The roots of trees and saplings shall be removed to a depth of 60 cm below ground level or 30 cm below formation level or 15 cm below sub-grade level, whichever is lower. All holes or hollows formed due to removal of roots shall be filled up with earth rammed and levelled. Trees, shrubs, poles, fences, signs, monuments, pipe lines, cable etc., within or adjacent to the area which are not required to be disturbed during jungle clearance shall be properly protected by the contractor at his own cost and nothing extra shall be payable.

2.16.2 Stacking and Disposal

All useful materials obtained from clearing and grubbing operation shall be stacked in the manner as directed by the Engineer-in-Charge. Trunks and branches of trees shall be cleared of limbs and tops and stacked neatly at places indicated by the Engineer-in-Charge. The materials shall be the property of the Government. All unserviceable materials which in the opinion of the Engineer-in-Charge cannot be used or auctioned shall be removed up to a distance of 50 m outside the periphery of the area under clearance. It shall be ensured by the contractor that unserviceable materials are disposed off in such a manner that there is no likelihood of getting mixed up with the materials meant for construction.

2.16.3 Clearance of Grass

Clearing and grubbing operation involving only the clearance of grass shall be measured and paid for separately and shall

2.17 FELLING TREES

2.17.1 Felling

While clearing jungle, growth trees above 30 cm girth (measured at a height of one metre above ground level) to be cut, shall be approved by the Engineer-in-Charge and then marked at site. Felling trees shall include taking out roots up to 60 cm below ground level or 30 cm below formation level or 15 cm below sub-grade level, whichever is lower. All excavation below general ground level arising out of the removal of trees, stumps etc. shall be filled with suitable material in 20 cm layers and compacted thoroughly so that the surfaces at these points conform to the surrounding area. The trunks and branches of trees shall be cleared of limbs and tops and cut into suitable pieces as directed by the Engineer-in-Charge.

2.17.2 Stacking and Disposal

Wood, branches, twigs of trees and other useful material shall be the property of the Government. The serviceable materials shall be stacked in the manner as directed by the Engineer-in-Charge upto a lead of 50m. All unserviceable material, which in the opinion of Engineer-in-Charge cannot be used or auctioned shall be removed from the area and disposed off as per the directions of the Engineer-in-Charge. Care shall be taken to see that unsuitable waste materials are disposed off in such a manner that there is no likelihood of these getting mixed up with the materials meant for construction.

S. No.	IS CODE	Subject
1	IS 269	Specification for 33 grade ordinary Portland cement
2	IS 383	Specification for coarse and fine aggregate from natural Source for concrete.
3	IS 455	Specification for Portland slag cement.
4	IS 460 (Part I	Specification for test sieves: wire cloth test sieves.
5	IS 650	Specification for standard sand for testing of cement
6	IS 1269	Specification for 53 grade ordinary Portland cement
7	IS 1344	Specification for calcined clay Pozzolana
8	IS 1489	Specification for Portland pozzolana cement
9	IS 1542	Specification for sand for plaster
10	IS 1727	Methods of Test for Pozzolanic materials
11	IS 2116	Specification for sand for masonry mortar.
12	IS 2250	Code of practice for preparation and use of masonry Mortar.
13	IS 2386 (Pt-I)	Method of test for aggregate for concrete (Particle size and shape)
14	IS 2386 (Pt-II)	Do- Estimation of deleterious materials and organic impurities.
15	IS 2386 (Pt-III)	Do- Specific gravity, density, voids, absorption and Bulking.
16	IS 3025	Method of sampling and test for water
17	IS 3406.	Specification for masonry cement.
18	IS 3812 (Part I)	Specification for flyash for use as pozzolana in cement mortar and concrete
19	IS 3812 (Part II)	Specification for flyash for use as admixture in cement mortar and concrete
20	IS 4031 (Part I) to(Part III)	Method of Physical test for hydraulic cement
21	IS 4032	Method of chemical analysis of Hydraulic cement.
22	IS 8041	Rapid hardening Portland cement.
23	IS 8042	Specification for white cement
24	IS 8043	Hydrophobic Portland cement
25	IS 8112	Specification for 43 grade ordinary Portland cement
26	IS 11652	Woven HDPE sacks for packing cement
27	IS 11653	Woven polypropylene sacks for packing cement
28	IS 12174	Jute synthetic union bags for packing cement

3.2 MATERIALS

3.2.1 Water: Water used for mixing and curing shall be clean and free from injurious quantities of alkalies, acids, oils, salts, sugar, organic materials, vegetable growth or other substance that may be deleterious to bricks, stone, concrete or steel potable water is generally considered satisfactory for mixing. The Ph value of water shall be not less than 6.The physical and chemical properties of ground water shall be tested along with soil investigation and if the water is not found conforming to the requirements of IS 456-2000, the tender documents shall clearly specify that the contractor has to arrange good quality water for construction indicating the source.

3.2.2 Cement: The cement used shall be any of the following grades and the type selected should be appropriate for the intended use.

a) 33 grade ordinary Portland cement conforming to IS 269.
b) 43 grade ordinary Portland cement conforming to IS 8112.
c) 53 grade ordinary Portland cement conforming to IS 12269.
d) Rapid hardening Portland cement conforming to IS 8041.
e) Portland slag cement conforming to IS 455.
f) Portland Pozzolana cement (flyash based) conforming to IS 1489 (Part 1).
g) Portland Pozzolana cement (calcined clay based) conforming to IS 1489 (part 2).
h) Hydrophobic cement conforming to IS 8043
i) Low heat Portland cement conforming to IS 12600.
j) Sulphate resisting Portland cement conforming to IS 12330
k) White cement conforming to IS 8042

Different types of cement shall not be mixed together. In case more than one type of cement is used in any work, a record shall be kept showing the location and the types of cement used.

3.2.3 Fine Aggregate

3.2.3.1 Aggregate most of which passes through 4.75 mm IS sieve is known as fine aggregate. Fine aggregate shall consist of natural sand, crushed stone sand, crushed gravel sand stone dust or marble dust, fly ash and broken brick (Burnt clay). It shall be hard, durable, chemically inert, clean and free from adherent coatings, organic matter etc. and shall not contain any appreciable amount of clay balls or pellets and harmful impurities e.g. iron pyrites, alkalies, salts, coal, mica, shale or similar laminated materials in such form or in such quantities as to cause corrosion of metal or affect adversely the hardening, the strength, the durability or the appearance of mortar, plaster or concrete. The sum of the percentages of all deleterious material shall not exceed 5%. Fine aggregate must be checked for organic impurities such as decayed vegetation humps, coal dust etc. in accordance with the procedure prescribed in CPWD specifications (vol. 1) 2009 Appendix 'A' of Chapter 3.

3.2.3.2 Silt Content: The maximum quantity of silt in sand as determined by the method prescribed in CPWD specifications (vol. 1) 2009 Appendix 'C' of Chapter 3 shall not

exceed 8%.Fine aggregate containing more than allowable percentage of silt shall be washed as many times as directed by Engineer-in-charge so as to bring the silt content within allowable limits for which nothing extra shall be paid.

3.2.3.3 Grading: On the basis of particle size, fine aggregate is graded in to four zones. The grading when determined in accordance with the procedure prescribed in CPWD specifications (vol. 1) 2009 Appendix 'B' of Chapter 3 shall be within the limits given in Table 3.1 below. Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron IS sieve, by a total amount not exceeding 5 per cent, it shall be regarded as falling within that grading zone.

TABLE 3.1 Fine Aggregates (clause 3.1.3 CPWD specification vol.1 2009)

IS SIEVE	Percentage passing for			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 microns	15-34	35-59	60-79	80-100
300 microns	5-20	8-30	12-40	15-50
150 microns	0-10	0-10	0-10	0-15

For crushed stone sands, the permissible limit on 150 micron sieve is increased to 20 percent. This does not affect the 5 per cent allowance permitted in 3.1.3.4 (e) (1) CPWD specification vol.1 2009 applying toothier sieves. Allowance of 5% permitted as specified in 3.1.3.4 (e) (1) (CPW D specification vol.1 2009) can be split up, for example it could be 1% on each of three sieves and 2% on another or 4% on one sieve and 1% on another. Fine aggregate conforming to Grading Zone IV shall not be used in reinforced cement concrete unless tests have been made to ascertain the suitability of proposed mix proportions. Sand requiring use for mortar for plaster work shall conform to IS 1542 and for masonry work shall conform to IS 2116.Type and grading of fine aggregate to be used shall be specified. It shall be coarse sand, fine sand, stone dust or marble dust, fly ash and surkhi. Use of sea sand shall not be allowed, unless otherwise specified.

(a) Coarse sand shall be either river sand or pit sand or a combination of the two. It shall be clean, sharp, angular, gritty to touch and composed of hard siliceous material. Its grading shall fall within the limits of grading zone I, II, III of Table 3.1. Grading of sand shall conform to IS 2116 for use in Masonry work.

(b) Fine sand shall be either river sand or pit sand or a combination of the two. Its grading shall fall within the limits of Grading zone IV of Table 53.1.Grading of sand shall conform to IS 1542 for use in plaster work.

(c) Stone dust shall be obtained by crushing hard stones or gravel. Its grading shall fall within the limits of grading Zone, I, II, or III of Table 3.1

(d) Marble dust shall be obtained by crushing marble. Its grading shall fall within the limits of Grading Zone IV of Table 3.1.Grading of Marble dust for use in Mortar shall be as per following table.

Grading of Marble dust

IS SIEVE	Percentage passing
10 mm	100
4.75 mm	95-100
2.36 mm	95-100
1.18 mm	90-100
600 microns	80-100
300 microns	15-50
150 microns	0-15

(e) Sand for Masonry Mortar and for Plaster Sand shall consist of natural sand, crushed stone sander crushed gravel sand or a combination of any of these. Sand shall be hard durable, clean and free from adherent coating and organic matter and shall not contain the amount of clay, silt and fine dust more than specified as under.

3.2.3.4 Deleterious Material: Sand shall not contain any harmful impurities such as iron, pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shale in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar. The maximum quantities of clay, fine silt, fine dust and organic impurities in the sand / Marble dust shall not exceed the following limits:

(1)Clay, fine silt and fine dust when determined in accordance within IS 2386 (Part II). In natural sand or crushed gravel sand & crushed stone sand	Not more than 5% by mass
(2)Organic impurities when determined in accordance with IS 2386 (Part II)	Colour of the liquid shall be lighter than that indicated by the standard specified in IS 2386 (Part II).

Grading of sand for use in masonry mortar shall be conforming to IS 216 (Table 3.2 below).

Grading of sand for use in plaster shall be conforming to IS 1542 (Table3.2 below):

TABLE 3.2 Grading of Sand for use in Masonry Mortar and Plaster

Grading of sand for use in masonry mortar		Grading of sand for use in plaster	
Is Sieve Designation	**Percentage passing by mass**	**Is Sieve Designation**	**Percentage passing by mass**
10 mm	100	10 mm	100
4.75 mm	100	4.75 mm	95-100
2.36 mm	90-100	2.36 mm	95-100
1.18 mm	70-100	1.18 mm	90-100
600 microns	40-100	600 microns	80-100
300 microns	5-70	300 microns	20-65
150 microns	0-15	150 microns	0-50

For crushed stone sands, the permissible limit on 150 micron IS Sieve is increased to 20%, this does not affect the 5% allowance as per IS 2386 (Part 1).

3.2.3.5 Bulking: Fine aggregate, when dry or saturated, has almost the same Volume but dampness causes increase in volume. In case fine aggregate is damp at the time of proportioning the ingredients for mortar or concrete, its quantity shall be increased suitably to allow for bulk age, which shall be determined by the method prescribed in CPWD specifications (vol. 1) 2009 Appendix 'D' of Chapter 3.0.

Table 3.3 Gives the relation between moisture content and percentage of bulking for guidance only.

Moisture Content % age	Bulking % age (by volume)
2	15
3	20
4	25
5	30

3.3. PREPARTATION OF MORTARS AND ITS GRADE

3.3.1 Grade of Masonry Mortar

The grade of masonry mortar will be defined by its compressive strength in N/mm2 at the age of 28days as determined by the standard procedure detailed in IS 2250.

For proportioning the ingredients by volume, the conversion of weight into volume shall be made on the following basis:

(a) Burnt Clay Pozzolana	860 Kg/cum
(b) Coarse Sand (dry)	1280 kg/cum
(c) Fine sand (dry)	1600 kg/ cum
(d) Fly Ash	590 kg/ cum

For details of grades and criteria for selection of Masonry mortars refer CPWD specifications (vol. 1) 2009 Appendix 'F' of chapter-3.0

3.3.2 Cement Mortar:

This shall be prepared by mixing cement and sand with or without the addition of pozzolana in specified proportions as per CPWD specifications (vol. 1) 2009 Appendix 'F' of Chapter 3 and its latest version of CPWD.

3.3.2. Proportioning:

Proportioning on weight basis shall be preferred taking into account specific gravity of sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic meter. Other ingredients unspecified proportion shall be measured using boxes of size 40 x 35 x 25 cm. Sand shall be measured on the basis of its dry volume in the case of volumetric proportioning.

3.3.2.2 Mixing:

The mixing of mortar shall be done in mechanical mixers operated manually or by power as decided by Engineer-in-Charge. The Engineer-in-Charge may, however, permit hand mixing at his discretion taking into account the nature, magnitude and location of the work and practicability of the use of mechanical mixers or where item involving small quantities are to be done or if in his opinion the use of mechanical mixer is not feasible. In cases, where mechanical mixers are not to be used, the contractor shall take permission of the Engineer-in-Charge in writing before the commencement of the work.

(a) Mechanical Mixing: Cement and sand in the specified proportions shall be mixed dry thorough lying a mixer. Water shall then be added gradually and wet mixing continued for at least three minutes. only the required quantity of water shall be added which will produce mortar of workable consistency but not stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time. Mixer shall be cleaned with water each time before suspending the work.

(b) Hand Mixing: The measured quantity of sand shall be leveled on a clean masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture is of a uniform colour. The quantity of dry mix which can be used within 30 minutes shall then be mixed in a masonry trough with just sufficient quantity of water to bring the mortar to a stiff paste of necessary working consistency.

3.3.2.3 Precautions:

Mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.

4.1 CONCRETE WORK: List of Bureau of Indian Standards Codes

S. No.	I.S No.	Subject
1	IS 383	Specification for coarse and fine aggregate from natural sources for concrete.
2	IS 456	Plain and reinforced concrete - Code of practice
3	IS 516	Method of test for strength of concrete
4	IS 1199	Method of sampling and analysis of concrete
5	IS 1200(Part II)	Method of measurement of building and civil engineering work (concrete work)
6	IS 1322	Specification for bitumen felt for water proofing and damp proofing.
7	IS 1791	General requirements for batch type concrete mixers
8	IS 2386	Method of test for aggregates for concrete
		(a) Part I - Particle size and shape
		(b) Part II - Estimation of deleterious materials and
		organic impurities
		(c) Part III - Specific gravity, density, voids absorption and bulking.
		(d) Part IV - Mechanical properties.
		(e) Part V – Soundness
9	IS 2505	General requirements for concrete vibrators - immersion type.
10	IS 2506	General requirements for concrete vibrators - screed board concrete vibrators
11	IS 2645	Specification for integral water proofing compounds for cement mortar and concrete
12	IS 3068	Specification for broken brick (burnt clay) coarse Aggregate for use in concrete.
13	IS 3812	Specification for flyash for use as pozzolana and admixture in cement mortar and concrete.
14	IS 4656	Specification for form vibrators for concrete.
15	IS 7861(Part-I)	Code of practice for extreme weather concreting (Part-I) recommended Practice for hot weather concreting.
16	IS 7861(Part–II)	Code of practice for extreme weather concreting (Part-II) recommended.
17	IS 9103	Specification for concrete admixtures

4.2 MATERIAL

Water, cement, fine aggregate or sand, surkhi, and fly ash shall be as specified in CPWD specifications (vol.1) 2009 Chapter 3.0 –Mortar.

4.2.1 Coarse Aggregate: Aggregate most of which is retained on 4.75 mm IS Sieve and contains only as much fine material as is permitted in IS 383 for various sizes and grading is known as coarse aggregate. Coarse aggregate shall be specified as stone aggregate, gravel or brick aggregate and it shall be obtained from approved/ authorized sources.

(a) Stone Aggregate: It shall consist of naturally occurring (uncrushed, crushed or broken) stones. It shall conform to IS 383 unless otherwise specified.

(b) Gravel: It shall consist of naturally occurring (uncrushed, crushed or broken) river bed shingle or pit gravel. These shall conform to IS 383 unless otherwise specified. (c)Brick Aggregate: Brick aggregate shall be obtained by breaking well burnt or over burnt dense brick/ brick bats. It shall conform to IS 306 unless otherwise specified. d)Light weight aggregate such as sintered fly ash aggregate may also be used provided the Engineer-in-Charge is satisfied with the data on the proportion of concrete made with them.

4.2.1.1 Deleterious Material: Course aggregate shall not contain any deleterious material, such as pyrites, coal, lignite, mica, shale or similar laminated material, clay, alkali, soft fragments, sea shells and organic impurities in such quantity as to affect the strength or durability of the concrete. Coarse aggregate to be used for reinforced cement concrete. Coarse aggregate to be used for reinforced cement concrete shall not contain any material liable to attack the steel reinforcement. Aggregates which are chemically reactive with alkalies of cement shall not be used. The maximum quantity of deleterious material shall not be more than five percent of the weight of coarse aggregate when determined in accordance with IS 2386.

4.2.1.2 Size and Grading

(i) Stone aggregate and gravel: It shall be either graded or single sized as specified. Nominal size and grading shall be as under:-

(a) Nominal sizes of graded stone aggregate or gravel shall be 40, 20, 16, or 12.5 mm as specified. For any one of the nominal sizes, the proportion of other sizes as determined by the method prescribed in CPWD specifications (vol.1) 2009 Appendix 'A of Chapter 4 and shall be in accordance with Table 4.1.

Table 4.1 Graded Stone Aggregate or Gravel

IS Sieve Designation	Percentage passing (by weight) for nominal size of			
	40 mm	20 mm	16 mm	12.5 mm
80mm	100	-	-	-
63mm	-	-	-	-
40mm	95-100	100	-	-
20mm	30-70	95-100	100	100
16mm	-	-	90-100	-
12.5mm	-	-	-	90-100
10mm	10-35	25-55	30-70	40-85
4.75mm	0-5	0-10	0-10	0-10

(b) Nominal sizes of single sized stone aggregate or gravel shall be 63, 40, 20, 16, 12.5 or 10 mm as specified. For any one of the nominal size, the proportion of

other sizes as determined by the method prescribed in CPW D specifications (vol.1) 2009 Appendix 'A' of Chapter 4 and shall be in accordance with Table 4.2.

Table 4.2 Single Sized (Ungraded) Stone Aggregate or Gravel

IS Sieve Designation	Percentage passing (by weight) for nominal size of					
	63 mm	**40 mm**	**20 mm**	**16 mm**	**12.5 mm**	**10 mm**
80mm	100	-	-	-	-	-
63mm	85-100	100	-	-	-	-
40mm	0-30	85-100	100	-	-	-
20mm	0-5	0-20	85-100	100	-	-
16mm	-	-	-	85-100	100	-
12.5mm	-	-	-	-	85-100	100
10mm	0-5	0-5	0-20	0-30	0-45	85-100
4.75mm	-	-	0-5	0-5	0-10	0-20
2.36mm	-	-	-	-	-	0-5

(c) When stone aggregate or gravel brought to site is single sized (ungraded), it shall be mixed with single sized aggregate of different sizes in the proportion to be determined by field tests to obtain graded aggregate of specified nominal size. For the required nominal size, the proportion of other sizes in mixed aggregate as determined by method prescribed in CPWD specifications (vol.1) 2009 Appendix 'A' of Chapter 4 and shall be in accordance with Table 4.1. Recommended proportions by volume for mixing of different sizes of single size (ungraded) aggregate to obtain the required nominal size of graded aggregate are given in Table 4.3.

Table 4.3 Single Sized (Ungraded) Stone Aggregate or Gravel

Cement concrete	Nominal size of graded aggregate	Parts of single size aggregate of size				
		50 mm	**40 mm**	**20 mm**	**12.5mm**	**10mm**
1	**2**	**3**	**4**	**5**	**6**	**7**
1:6:12	6	9	-	3	-	-
1:6:12	4	-	9	3	-	-
1:5:10	6	7.5	-	2.5	-	-
1:5:10	4	-	7.5	2.5	-	-
1:4:8	6	6	-	2	-	-
1:4:8	4	-	6	2	-	-
1:3:6	6	4.5	-	1.5	-	-
1:3:6	4	-	4.5	1.5	-	-
1:3:6	2	-	-	4.5	-	1.5
1:2:4	4	-	2.5	1	-	1.5
1:2:4	2	-	-	3	-	1
1:2:4	12.	-	-	-	3	1
1: 11/2 :3	2	0	0	2	-	1

The proportions indicated in Table 4.3 above are by volume when considered necessary, these proportions may be varied marginally by Engineer-in-

Charge after making sieve analysis of aggregate brought to site for obtaining required graded aggregate. No adjustments in rate shall be made for any variation in the proportions so ordered by the Engineer-in-Charge. If single size coarse aggregate are not premixed at site to obtain the graded coarse aggregate required for the mix, the volume of single size aggregates required for the mix shall be suitably increased to account for reduction in total volume at the site of mixing.

4.3 Grades of Cement Concrete

The concrete shall be in grade designated as under:

TABLE 4.4 Grades of Concrete

Group	Grade Designation	Specified characteristic compressive strength of 150 mm Cube at 28 Days in N/mm^2
Ordinary Concrete	M10	10
	M15	15
	M20	20
Standard Concrete	M25	25
	M30	30
	M35	35
	M40	40
	M45	45
	M50	50
	M55	55
High Strength Concrete	M60	60
	M65	65
	M70	70
	M75	75
	M80	80

Table 4.5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal; Maximum Size (Clause 4.2.1.1 CPWD specification vol.1 2009)

S. No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m3	Maximum Free Water Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m3	Maximum Free Water Cement Ratio	Minimum Grade of Concret
1	Mild	220	0.60	-	300	0.55	M20
2	Moderate	240	0.60	M15	300	0.50	M25
3	Severe	250	0.50	M20	320	0.45	M30
4	Very Severe	260	0.45	M20	340	0.45	M35
5	Extreme	280	0.40	M25	360	0.40	M40

1. Cement content prescribed in this Table is irrespective of the grades of cement. The additions such as fly or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water- cement ratio, if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.
2. Minimum grade for plain concrete under mild exposure condition is not specified.
3. The above minimum cement content and maximum water cement ratio apply only to 20 mm nominal maximum size aggregate. For other sizes of aggregate, these should be changed as per Table 6 of IS 456.

   The minimum grade of concrete for plain and reinforced concrete shall be as per Table 4.5.

4.4 Workability of Concrete

4.4.1 The concrete mix proportion chosen should be such that the concrete is of adequate workability for the placing conditions of the concrete and can properly be compacted with the means available. Suggested ranges of workability of concrete measured in accordance with IS 1199

4.4.2. In the 'very low' category of workability where strict control is necessary, for example, pavement quality concrete, measurement of workability be determination of compacting factor will be more appropriate than slump (see IS 1199) and a value of compacting factor of 0.75 to 0.80 is suggested.

4.4.3 In the 'very high'' category of workability, measurement of workability by determination of flow will be appropriate (see IS 9103).

4.5 Concrete Mix Proportioning

4.5.1 The determination of the proportion of cement, aggregate and water to attain the required strength shall be made as follows:

(a) By designing the concrete mix: such concrete shall be called 'Design mix concrete', for details reference made to CPWD specifications (vol.1) 2009 Chapter -5 RCC

(b) By adopting nominal concrete mix: such concrete shall be called 'Nominal mix concrete'.

Design mix concrete is preferred to nominal mix. If design mix concrete cannot be used for any reason on the work for grades of M20 or lower, nominal mixes may be used with the permission of Engineer-in-Charge, which, however, is likely to involve higher cement content.

6.5.2 Nominal Mix Concrete: Nominal Mix Concrete may be used for concrete of M20 or lower. The proportions of materials for nominal mix concrete shall be in accordance with Table 4.6. The cement content of the mix specified in Table 4.6

for any nominal mix shall be proportionately increased if the quantity of water in the mix has to be increased to overcome the difficulty or placement and compaction, so that the water cement ratio as specified is not exceeded.

Table 4.6 Proportions for Nominal Mix Concrete

(Clause 4.2.3.2 Clause 4.2.1.1 in CPWD specification vol.1 2009))

Grade of Concrete	Total Quantity of Dry Aggregates by Mass per 50 kg of cement, to be taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, Kg. Max	Proportion of Fine Aggregate to Coarse Aggregate (by Mass)	Quantity Of Water per 50 kg of Cement, max Ltr.
M5	800	Generally1:2 but subject to an upper limit of 1: 1 ½ and a lower limit of1:2 ½	60
M7.5	625		45
M10	480		34
M15	330		32
M20	250		30

The proportion of the fine to coarse aggregate should be adjusted from upper limit progressively as the grading of fine aggregate becomes finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregate shall be used. Quantity of water required from durability point of view may be less than the value given above.

4.6 Batching

To avoid confusion and error in batching, consideration should be given to using the smallest practical number of different concrete mixed on any site or in any one plant. In batching concrete, the quantity of both cement and aggregate shall be determined by mass; admixture, if solid, by mass: liquid admixture may however be measured in volume or mass: water shall be weighed or measured by volume in a calibrated tank (see also IS 4925).

Ready-mixed concrete supplied by ready-mixed concrete plant shall be preferred. For large and medium project sites the concrete shall be sourced from ready-mixed concrete plants or from on site or off site batching and mixing plants (see IS 4926).

4.6.1 Except where it can be shown to the satisfaction of the Engineer-in-Charge that supply of properly graded aggregate of uniform quality can be maintained over a period of work, the grading aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions when required, the different sizes being stocked in separate stock-piles. The material should be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge to ensure that the specified grading is maintained.

4.6.2 The accuracy of the measuring equipment shall be within + 2 percent of the quantity of cement being measured and within + 3 percent of the quantity of aggregate, admixtures and water being measured.

4.6.3 Proportion/Type and grading of aggregates shall be made by trial in such a way so as to obtain densest possible concrete. All ingredients of the concrete should be used by mass only.

4.6.4 Volume batching may be allowed only where weigh-batching is not practicable and provided accurate used in concrete have earlier been established. Allowance for bilking shall be mad in accordance with IS 2386 (Part 3). The mass volume relationship should be checked as frequently as necessary, the frequency for the given job being determined by Engineer-in-Charge to ensure that the specified grading is maintained.

4.6.5 It is important to maintain the water cement ratio constant at its correct value. To this end, determination of moisture contents in both fine and coarse aggregates shall be made as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge according to weather conditions. The amount of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS 2386 (Part 3) may be referred to. To allow for the variation in mass for aggregate due to variations in their moisture content, suitable adjustments in the masses of aggregates shall be made.

4.6.6 No substitutions in materials used on the work or alteration in the established proportions, except as permitted in 4.2.4.4 and 4.2.4.5(CPWD Specification vol1 2009) shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

4.7 Mixing

Concrete shall be mixed in mechanical batch type concrete mixers conforming to IS 1791 having two blades and fitted with power loader (lifting hopper type). Half bag mixers and mixers without lifting hoppers shall not be used for mixing concrete. In exceptional circumstances, such as mechanical breakdown of mixer, work in remote areas or power breakdown and when the quantity of concrete work is very small, hand mixing may be done with the specific prior permission of the Engineer-in- Charge in writing subject to adding 10% extra cement. When hand mixing is permitted, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the concrete is uniform in colour and consistency. Before mixing the brick aggregate shall be well soaked with water for a minimum period of two hours and stone aggregate or gravel shall be washed with water to remove, dirt, dust and other foreign materials. For guidance, the mixing time may be 11/2 to 2 minutes, for hydrophobic cement it may be taken as 21/2 to 3 minutes. For Machine Mixing,

Hand mixing, transportation and Handling refer CPWD specifications (vol.1) 2009 chapter-4.

4.8 Placing

The concrete shall be deposited as nearly as practicable in its final position to avoid rehandling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains. As a general guidance, the maximum free fall of concrete may be taken as 1.5 metre.

4.9 Compaction

Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Compaction shall be done by mechanical vibrator of appropriate type till a dense concrete is obtained. The mechanical vibrators shall conform to IS 2505, IS 2506, IS 2514 and IS 4656. To prevent segregation, over vibration shall be avoided. Compaction shall be completed before the initial setting starts. For the items where mechanical vibrators are not to be used, the contractor shall take permission of the Engineer-in-Charge in writing before the start of the work. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

4.10 Construction Joints

Concreting shall be carried out continuously upto construction joints. The position and arrangement of construction joints shall be as shown in the structural drawings or as directed by the Engineer-in- Charge. Number of such joints shall be kept minimum. Joints shall be kept as straight as possible. Construction joints should comply with IS 11817.

4.10.1 When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean and thoroughly wetted. For vertical joints, neat cement slurry, of workable consistency by using 2 kgs of cement per sqm shall be applied on the surface before it is dry. For horizontal joints, the surface shall be covered with a layer of mortar about 10-15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry of mortar shall be freshly mixed and applied immediately before placing of the concrete.

4.10.2 Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles of coarse aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry @2 kgs of cement per sqm. On this surface, a layer of concrete not exceeding 150 mm in thickness shall first be placed and

shall be well rammed against old work particular attention being paid to corners and close spots; work, thereafter, shall proceed in the normal way.

4.11. Concreting under Special Conditions

4.11.1 Work in Extreme Weather Conditions: During hot and cold weather, the concreting shall be done as per the procedure set out in IS 7861 (Part–I)-1975 and IS 7861 (Part II)-1981 respectively. Concreting shall not be done when the temperature falls below 4.5ºC. In cold weather, the concrete placed shall be protected against frost. During hot weather, it shall be ensured that the temperature of wet concrete does not exceed 38°C.

4.11.2 Under Water Concreting: Concrete shall not be deposited under water if it is practicable to de- water the area and place concrete in the regular manner. When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of the mix to be used shall be submitted to and approved by the Engineer-in-Charge before the work is started.

Under-water concrete should have a slump recommended in 4.2.2(CPWD specification vol 1 2009). The water-cement ratio shall not exceed 0.6 and may need to be smaller, depending on the grade of concrete or the type of chemical attack. For aggregates of 40 mm maximum particle size, the cement content shall be atleast 350 kg/m3 of concrete.

4.12 Curing

Curing is the process of preventing loss of moisture from the concrete. The following methods shall be employed for effecting curing.

4.12.1 Moist Curing: Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacking, canvas, Hessian or similar materials and kept constantly wet for at least 7 days from the date of placing concrete in case of ordinary Portland cement and at least 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather conditions. In the case of concrete where mineral admixtures or blended cements are used, it is recommended that above minimum periods may be extended to 14 days.

4.12.2 Membrane Curing: Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer-in-Charge. Such compound shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set. Impermeable membrane such as polythene sheet covering the concrete surface may also be used to provide effective barrier against the evaporation.

4.12.3 Freshly laid concrete shall be protected from rain by suitable covering.

4.12.4 Over the foundation concrete, the masonry work may be started after 48 hours of its compaction but the curing of exposed surfaces of cement concrete shall be continued along with the masonry work for at least 7 days. And where cement concrete is used as base concrete for flooring, the flooring may be commenced before the curing period of base concrete is over but the curing of base concrete shall be continued along with top layer of flooring for a minimum period of 7 days.

4.13 Finishes

Plastering and special finishes other than those, obtained through form work shall be specified and paid for separately unless otherwise specified.

4.14 Durability of Concrete

A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. The materials and mix proportions shall be such as to maintain its intergrity and, if applicable, to protect reinforcement from corrosion.

The factors influencing durability include:

(a) The environment;

(b) The cover to embedded steel;

(c) The type and quality of constituent materials;

(d) The cement content and water/ cement ratio of the concrete;

(e) Workmanship, to obtain full compaction and efficient curing; and

(f) The shape and size of the member.

4.15 DAMP PROOF COURSE

4.15.1 Cement Concrete Layer

This shall consist of cement concrete of specified proportions and thickness. The surface of brick or stone masonry work shall be levelled and prepared before laying the cement concrete. Edge of damp proof course shall be straight, even and vertical. Side shuttering shall consist of steel forms and shall be strong and properly fixed so that it does not get disturbed during compaction and the mortar does not leak through. The concrete mix shall be of workable consistency and shall be tamped thoroughly to make a dense mass. When the sides are removed, the surface should come out smooth without honey- coming. Continuity shall be maintained while laying the cement concrete layer and laying shall be terminated only at the predetermined location where damp proof course is to be discontinued. There shall be no construction joints in the Damp Proof Course

4.15.2 Curing

Damp proof course shall be cured for at least seven days, after which it shall be allowed to dry.

4.15.3 Application of Hot Bitumen

Where so directed, hot bitumen in specified quantity shall be applied over the dried up surface of cement concrete, properly cleaned with brushes and finally with a piece of cloth soaked in kerosene oil. Bitumen of penetration A 90 or equivalent where used shall be heated to a temperature of 160º ± 5ºC. The hot bitumen shall be applied uniformly all over, so that no blank spaces are left anywhere.

4.15.4 Water Proofing Materials

Where so specified, water proofing material of approved quality shall be added to the concrete mixture in accordance with the manufacturer's specification stating the quantity of water proofing material in litres or kg per 50 kg or cement

5.1 REINFORCED CEMENT: List of Bureau of Indian Standards Codes

S. No.	I.S Code	Subject
1.	IS226	Structural Steel
2.	IS432(Part I)	Specification for mild steel and medium tensile steel bar Sand hard drawn steel wire for concrete reinforcement part-I mild steel and medium tensile steel bars.
3.	IS432(Part II)	Specification for mild steel and medium tensile steel bar sand hard drawn steel wire for concrete reinforcement–
4.	IS456	Code of Practices for plain and Rein forced concrete.
5.	IS516	Method of test for strength of concrete.
6.	IS716	Specification for pentachlorophenol
7.	IS1199	Method of sampling and analysis of concrete.
8.	IS1200(Part II)	Method of measurement of building and civil engineering
9.	IS1200(Part V)	Method of measurement of building and civil engineering
10.	IS1566	Specification for hard drawn steel wire fabric for concrete requirement.
11.	IS1599	Method for bend test
12.	IS1343	Code of Practice for Prestressed Concrete
13.	IS1608	Method for tensile testing of steel products
14.	IS1786	Specification for high strength deformed steel and wires for concrete reinforcement.
15.	IS1791	Specification for batch type concrete mixes
16.	IS2502	Code of practice for bending and fixing of bars for concrete reinforcement.
17.	IS2751	Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.
18.	IS4925	Batch plants specification for concrete batching and mixing plant
19.	IS4926	Ready Mixed Concrete
20.	IS6523	Specification for precast reinforced concrete door, window frames
21.	IS10262	Recommended guidelines for concrete mix design

22.	IS13311	Indian standard for non-destructive testing of concrete. Method of test for ultrasonic pulse velocity
23.	IS13311	Indian standard for non-destructive testing of concrete. Method of testing by rebound hammer.

5.2 MATERIALS:

Water, cement, fine and coarse aggregate shall be as specified under respective clauses of CPWD Specification (vol.1) 2009 chapter 03 mortars and chapter 04 concrete works as applicable.

5.3 Steel for Reinforcement

5.3.1 The steel used for reinforcement shall be any of the following types:

(a) Mild steel and medium tensile bars conforming to IS 432 (Part I)
(b) High strength deformed steel bars conforming to IS 1786
(c) Hard drawn steel wire fabric conforming to IS 1566
(d) Structural steel conforming to Grade A of IS 2062
(e) Thermo-mechanically treated (TMT) Bars.

5.3.2 Elongation percent on gauge length is $5.65\sqrt{}$ where A is the cross sectional areas of the test piece

5.3.3 Mild steel is not recommended for the use in structures located in earthquake zone subjected to severe damage and for structures subjected to dynamic loading (other than wind loading) such as railway and highway bridges.

5.3.4 Welding of reinforcement bars covered in this specification shall be done in accordance with the requirements of IS 2751.

5.4 FORM WORK (CENTRING & SHUTTERING): Form work shall include all temporary or permanent forms or moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support.

5.4.1 Design & Tolerance in Construction

Form work shall be designed and constructed to the shapes, lines and dimensions shown on the drawings with the tolerance given below.

(a)	Deviation from specified dimension of cross	+12 mm
	Section of columns and beams	-6 mm
(b)	Deviation from dimensions of footings	
(i)	Dimension in Plan	(+ 50 mm
		(-12 mm
(ii)	Eccentricity in plan	0.02 times the width of the footing in the direction of deviation but not more than 50 mm.
(iii)	Thickness	$\pm$ 0.05 times the specified

		thickness.

5.4.2 General Requirement:

It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces, screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete. Form shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections, care shall be taken to see that no piece is keyed into the concrete.

5.4.2.1 Material for Form Work:

Propping and Centering: All propping and centering should be either of steel tubes with extension pieces or built up sections of rolled steel.

5.4.2.2 (a) Centering/Staging: Staging should be as designed with required extension pieces as approved by Engineer-in-Charge to ensure proper slopes, as per design for slabs/ beams etc. and as per levels as shown in drawing. All the staging to be either of Tubular steel structure with adequate bracings as approved or made of built up structural sections made form rolled structural steel sections.

(b) In case of structures with two or more floors, the weight of concrete, centering and shuttering of any upper floor being cast shall be suitably supported on one floor below the top most floor already cast.

(c) Form work and concreting of upper floor shall not be done until concrete of lower floor has set at least for 14 days.

5.4.3 Shuttering:

Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. If required, rubberized lining of material as approved by the Engineer-in-Charge shall be provided in the joints. Steel shuttering used or concreting should be sufficiently stiffened. The steel shuttering should also be properly repaired before use and properly cleaned to avoid stains, honey combing, seepage of slurry through joints etc.

(a) Runner Joists: RSJ, MS Channel or any other suitable section of the required size shall be used as runners.

(b) Assembly of beam head over props. Beam head is an adopter that fits snugly on the head plates of props to provide wider support under beam bottoms.

(c) Only steel shuttering shall be used, except for unavoidable portions and very small works for which 12 mm thick water proofing ply of approved quality may be used.

5.4.3.1 Form work shall be properly designed for self-weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment). In case the height of centering exceeds 3.50 metres, the prop may be provided in multi-stages.

5.4.4 Camber:

Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The form work shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per metre (1 to 250) or as directed by the Engineer-in-Charge, so as to offset the subsequent deflection, for cantilevers the camber at free end shall be 1/50th of the projected length or as directed by the Engineer-in-Charge.

5.4.5 Walls:

The form faces have to be kept at fixed distance apart and an arrangement of wall ties with spacer tubes or bolts is considered best. The two shutters of the wall are to be kept in place by appropriate ties, braces and studs, some of the accessories used for wall form.

5.4.6 Removal of Form work (Stripping Time):

In normal circumstance and where various types of cements are used, forms may generally be removed after the expiry of the following periods:

Type of Formwork	**Minimum period Before Striking Formwork for OPC33grade**	**Minimum period Before Striking Form work for OPC43grade**	**Minimum period Before Striking Form work for PPC**
(a)Vertical form work to columns, walls, beams	16-24h	16-24h	24-36h
Type of Formwork	Minimum period Before Striking Formwork for OPC33grade	Minimum period Before Striking Formwork for OPC 43grade	Minimum period Before Striking Form work for PPC
(b) Soffit form work to Slabs (Propsto bere-fixed immediately after removal of	3days	3days	4days
(c)Soffit form work to beams(Props to bere fixed immediately after removal of formwork	7days	7days	10days
(d) Propsto slabs (1) Spanning up to4.5m (2) Spanningover4.5m	 7days 14days	 7days 14days	 10days 20days

5.4.7 Oiling the Surface:

Shuttering gives much longer service life if the surfaces are coated with suitable mould oil which acts both as a parting agent and also gives surface protections.

A typical mould oil is heavy mineral oil or purified cylinder oil containing not less than 5% pentachlorophenol conforming to IS 716 well mixed to a viscosity of 70-80 centipoises.

After 3-4 uses and also in cases when shuttering has been stored for a long time, it

should be recoated with mould oil before the next use.

The second categories of shuttering oils/leavening agents are Polymer based water soluble Compounds. They are available as concentrates and when used diluted with water in the ratio of 1:20 or as per manufacturer specifications. The diluted solution is applied by brush applications on the shuttering both of steel as well as ply wood. The solution is applied after every use.

5.4.7.1 The design of form work shall conform to sound Engineering practices and relevant IS codes.

5.4.8 Inspection of Form Work

The completed form work shall be inspected and approved by the Engineer-in-Charge before the reinforcement bars are placed in position. Proper form work should be adopted for concreting so as to avoid honey combing, blow holes, grout loss, stains or discoloration of concrete etc. Proper and accurate alignment and profile of finished concrete surface will be ensured by proper designing and erection of form work which will be approved by Engineer-in-Charge. Shuttering surface before concreting should be free from any defect/ deposits and full cleaned so as to give perfectly straight smooth concrete surface. Shuttering surface should be therefore checked for any damage to its surface and excessive roughness before use.

5.4.9 Erection of Form Work (Cantering and shuttering):

Following points shall be borne in mind while checking during erection.

(a) Any member which is to remain in position after the general dismantling is done should be clearly marked.

(b) Material used should be checked to ensure that, wrong items/ rejects are not used.

(c) If there are any excavations nearby which may influence the safety of form works, corrective and strengthening action must be taken.

(d) (i) The bearing soil must be sound and well prepared and the sole plates shall bear well on the ground.

(ii) Sole plates shall be properly seated on their bearing pads or sleepers.

(iii) The bearing plates of steel props shall not be distorted.

(iv) The steel parts on the bearing members shall have adequate bearing areas.

(e) Safety measures to prevent impact of traffic, scour due to water etc. should be taken. Adequate precautionary measures shall be taken to prevent accidental impacts etc.

(f) Bracing, struts and ties shall be installed along with the progress of form work to ensure strength and stability of form work at intermediate stage. Steel sections (especially deep sections) shall be adequately restrained against tilting, overturning and form work should be restrained against horizontal loads. All the securing devices and bracing shall be tightened.

(g) The stacked materials shall be placed as catered for, in the design.

(h) When adjustable steel props are used. They should:

1. be undamaged and not visibly bent.
2. Have the steel pins provided by the manufacturers for use.
3. Be restrained laterally near each end.

4. Have means for centralizing beams placed in the fork heads.

(i) Screw adjustment of adjustable props shall not be over extended.

(j) Double wedges shall be provided for adjustment of the form to the required position wherever any settlement/ elastic shorting of props occurs. Wedges should be used only at the bottom end of single prop. Wedges should not be too steep and one of the pair should be tightened/ clamped down after adjustment to prevent shifting.

(k) No member shall be eccentric upon vertical member.

(l) The number of nuts and bolts shall be adequate.

(m) All provisions of the design and/or drawings shall be complied with.

(n) Cantilever supports shall be adequate.

(o) Props shall be directly under one another in multistage constructions as far as possible.

(p) Guy ropes or stays shall be tensioned properly.

(q) There shall be adequate provision for the movements and operation of vibrators and other construction plant and equipment.

(r) Required camber shall be provided over long spans.

(s) Supports shall be adequate, and in plumb within the specified tolerances.

5.5 REINFORCEMENTS

5.5.1 General Requirements

Steel for reinforcement shall be clear and free from loose mill scales, dust, loose rust, coats of paints, oil or other coating which may destroy or reduce bond. It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Prior to assembly of reinforcement on no account any oily substance shall be used for removing the rust.

5.5.1.1 Assembly of Reinforcement:

Bars shall be bent correctly and accurately to the size and shape as shown in the detailed drawing or as directed by Engineer-in-Charge. Preferably bars of full length shall be used. Necessary cutting and straightening is also included. Overlapping of bars, where necessary shall be done as directed by the Engineer-in-Charge. The overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25mm or times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceeding twice the dia. of such bars with two strands annealed steel wire of 0.90 mm to 1.6 mm twisted tight. The overlaps/ splices shall be staggered as per directions of the Engineer-in-Charge. But in no case the overlapping shall be provided in more than 50% of cross sectional area at one section.

5.5.1.2 Bonds and Hooks Forming End Anchorages:

Reinforcement shall be bent and fixed in accordance with procedure specified in IS 2502, code of practice of bending and fixing of bars for concrete reinforcement. The details of bends and hooks are shown below for guidance.

(a) U-Type Hook

In case of mild steel plain bars standard U type hook shall be provided by bending

ends of rod into semicircular hooks having clear diameter equal to four times the diameter of the bar. In case of work in seismic zone, the size of hooks at the end of the rod shall be eight times the diameter of bar or as given in the structural drawings.

(b) Bends

Bend forming anchorage to a M.S. plain bar shall be bent with and internal radius equal to two times the diameter of the bar with a minimum length beyond the bend equal to four times the diameter of the bar.

5.5.1.3 Anchoring Bars in Tension:

Deformed bars may be used without end anchorages provided, development length equipment is satisfied. Hooks should normally be provided for plain bars in tension. Development length of bars will be determined as per IS: 456.

5.5.1.4 Anchoring Bars in Compression:

The anchorage length of straight bar in compression shall be equal to the 'Development length' of bars in compression as specified in IS: 456. The projected length of hooks, bend and straight lengths beyond bend, if provided for a bar in compression, shall be considered for development length.

5.5.1.5 Binders, stirrups, links etc.:

In case of binders, stirrups, links etc. the straight portion beyond the curve at the end shall be not less than eight times and nominal size of bar.

5.5.2 Welding of Bars

Wherever facility for electric arc welding or gas pressure welding is available, welding of bars shall be done in lieu of overlap. The location and type of welding shall be got approved by the Engineer-in-Charge. Welding shall be as per IS 2751 and 9417.

5.5.3 Placing in Position

5.5.3.1 Fabricated reinforcement bars shall be placed in position as per the drawings or as directed by the Engineer-in-charge. The bars crossing one another shall be tied together at every intersection with two strands of annealed steel wire 0.9 to 1.6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete. Tack welding in crossing bars shall also be permitted in lieu of binding with steel wire if approved by Engineer-in-Charge.

5.5.3.2 The bars shall be kept in correct position by the following methods:

(a) In case of beam and slab construction pre-cast cover blocks in cement mortar 1:2 (1 cement : 2 coarse sand) about 4x4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcements.

(b) In case of cantilevered and doubly reinforced beams of slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 mere or at shorter spacing to avoid sagging.

(c) In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them: or with clock of cement mortar 1:2 (1 cement: 2 coarse sand) of required size suitable tied to the reinforcement to ensure that they are in correct position during concreting.

(d) In case of other R.C.C. structure such as arches, domes, shells, storage tanks

etc. a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in-Charge.

5.5.3.3 Tolerance on Placing of Reinforcement:

Unless otherwise specified by the Engineer-in-Charge, reinforcement shall be placed within the following tolerances: Tolerance in spacing

(a) For effective depth, 200 mm or less +10 mm

(b) For effective depth, more than 200 mm + 15 mm

5.5.3.4 Bending at Construction Joints:

Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position care should be taken to ensure that at no time the radius of the bend is less than 4 bar diameters for plain mild steel or 6 bar diameter for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

5.5.3.5 Cover:

The minimum nominal cover to meet durability requirements shall be as under:-

Exposure	Nominal Concrete cover in mm not less than
Mild	20
Moderate	30
Severe	45
Very severe	50
Extreme	75

5.6 CONCRETING:

The concrete shall be as specified under CPWD specification (vol.1) 2009 chapter 4 concrete work. The proportion by volume or by the weight of ingredients shall be as specified.

5.6.1 Consistency

The concrete which will flow sluggishly into the forms and around the reinforcement without any segregation of coarse aggregate from the mortar shall be used. The consistency shall depend on whether the concrete is vibrated on or hand tamped, it shall be determined by slump test as prescribed in sub-head —concretell under workability – requirement.

5.6.2 Placing of Concrete

5.6.2.1 Concreting shall be commenced only after Engineer-in-Charge has inspected the cantering, shuttering and reinforcement as placed and passed the same. Shuttering shall be clean and free from all shavings, saw dust, pieces of wood, or other foreign material.

5.6.2.2 In case of concreting of slab and beams, wooden plank or cat walks of chequered MS plated or bamboo chalies or any other suitable material supported directly on the centring by means of wooden blocks or lugs shall be provided to convey the concrete to the place of deposition without disturbing the reinforcement in any way. Labour shall not be allowed to walk over the reinforcement.

5.6.2.3 In case of columns and wall, it is desirable to place concrete without construction joints. The progress of concreting in the vertical direction shall be restricted to one metre per hour.

5.6.2.4 The concrete shall be deposited in its final position in a manner to preclude segregation of ingredients. In deep trenches and footings concrete shall be placed through chutes or as directed by the Engineer-in-Charge. In case of columns and walls, the shuttering shall be so adjusted that the vertical drop of concrete is not more than 1.5 metre at a time.

5.6.2.5 During cold weather, concreting shall not be done when the temperature falls below 4.5°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone.

5.6.2.6 During hot weather precaution shall be taken to see that the temperature of wet concrete does not exceed 38ºC. No concrete shall be laid within half an hour of the closing time of the day, unless permitted by the Engineer-in-Charge.

5.6.2.7 It is necessary that the time between mixing and placing of concrete shall not exceed 30 minutes so that the initial setting process is not interfered with.

5.6.3 Compaction: It shall be as specified in sub-head of Concrete Work of CPWD Specification vol.1 2009

5.6.3.1 Concrete shall be compacted into dense mass immediately after placing by means of mechanical vibrators designed for continuous operations complying with IS 2505, IS 2506, IS 2514 and IS 4656. The Engineer-in-Charge may however relax this condition at his discretion for certain items depending on the thickness of the members and feasibility of vibrating the same and permit hand compaction instead. Hand compaction shall be done with the help of tamping rods so that concrete is thoroughly compacted and completely worked around the reinforcement, embedded fixtures, and into corners of the form.

5.6.3.2 Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped in case of vibrating tables and external vibrators. Needle vibrators shall be withdrawn slowly so as to prevent formation of loose pockets in case of internal vibration. In case both internal and external vibrators are being used, the internal vibrator shall be first withdrawn slowly after which the external vibrators shall be stopped so that no loose pocket is left in the body of the concrete.

5.6.4 Construction joints

5.6.4.1 Concreting shall be carried out continuously upto the construction joints, the position and details of which shall be as per structural drawing or as directed by Engineer in- Charge. Number of such joints shall be kept to minimum. The joints shall be kept at places where the shear force is the minimum. These shall be straight and shall be at right angles to the direction of main reinforcement. Construction joints should comply with IS 11817.

5.6.4.2 In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head. The portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.

5.6.4.3 When stopping the concrete on a vertical plane in slabs and beams, and approved stop board shall be placed with necessary slots for reinforcement bars or any other obstruction to pass the bars freely without bending. The construction joints shall be keyed by providing a triangular or trapezoidal fillet nailed on the stop board. Inclined or feather joints shall not be permitted. Any concrete flowing through the joints of stop board shall be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.

5.6.4.4 When the work has to be resumed, the joint shall be thoroughly cleaned with wire brush and loose particles removed. A coat of neat cement slurry at the rate of 2.75 kg of cement per square metre shall then be applied on the roughened surface before fresh concrete is laid.

5.6.5 Expansion Joints

Expansion joints shall be provided as per the structural drawings or as directed by Engineer-in-Charge, for the purpose of general guidance. However it is recommended that structures exceeding 45 m in length shall be divided by one or more expansion joints. The filling of these joints with bitumen filler, bitumen felt or any such material and provision of copper plate, etc. shall be paid for separately in running metre. The measurement shall be taken two places of decimal stating the depth and width of joint.

5.6.6 Curing

After the concrete has begun to harden i.e. about 1 to 2 hours after its laying, it shall be protected from quick drying by covering with moist gunny bags, sand, canvass Hessian or any other material approved by the Engineer-in-Charge. After 24 hours of laying of concrete, the surface shall be cured by ponding with water for a minimum period of 7 days from the date of placing of concrete in case of OPC and at least 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather condition.

5.6.7 Finishing

5.6.7.1 In case of roof slabs the top surface shall be finished even and smooth with wooden trowel, before the concrete begins to set. Sprinkling of dry cement while finishing shall not be resorted to.

5.6.7.2 Immediately on removal of forms, the R.C.C. work shall be examined by the Engineer-in-Charge, before any defects are made good.

(a) The work that has sagged or contains honey combing to an extent detrimental to structural safety or architectural concept shall be rejected

(b) Surface defects of minor nature may be accepted. On acceptance of such a work by the Engineer-in-Charge, the same shall be rectified as follows:

1. Surface defects which require repair when forms are removed, usually consist of bulged due to movement of forms, ridges at form joints, honey-combed areas, damage resulting from the stripping of forms and bolt holes, bulges and ridges are removed by careful chipping or tooling and the surface is then rubbed with a grinding stone. Honey-combed and other defective areas must be chipped out, the edges being cut as straight as possible and perpendicularly to the surface, or preferably slightly under cut to provide a key at the edge of the patch
2. Shallow patches are first treated with a coat of thin grout composed of one part of cement and one part of fine sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers not more than 10mm thick and each layer is given a scratch finish to secure bond with the succeeding layer. The last layer is finished to match the surrounding concrete by floating, rubbing or tooling on formed surfaces by pressing the form material against the patch while the mortar is still plastic.
3. Large and deep patches require filling up with concrete held in place by forms. Such patches are reinforced and carefully dowelled to the hardened concrete.
4. Holes left by bolts are filled with mortar carefully packed into places in small amounts. The mortar is mixed as dry as possible, with just enough water so that it will be tightly compacted when forced into place.
5. Tiered holes extending right through the concrete may be filled with mortar with a pressure gun similar to the gun used for greasing motor cars.
6. Normally, patches appear darker than the surrounding concrete, possibly owing to the presence on their surface of less cement laitance. Where uniform surface colour is important, this defect shall be remedied by adding 10 to 20 percent of white Portland cement to the patching mortar, the exact quantity being determined by trial.
7. The same amount of care to cure the materials in the patches should be taken as with the whole structure. Curing must be started as soon as possible, after the patch is finished to prevent early drying. Damp Hessian may be used but in some locations it may be difficult to hold it in place. A membrane curing compound in these cases will be most convenient.

(c) The exposed surface of R.C.C. work shall be plastered with cement mortar 1:3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give smooth and even surface true to line and form .Any RCC surface which remains permanently exposed to view in the completed structure, shall be considered

exposed surfaced for the purpose of this specification. Where such exposed surface exceeding 0.5 sqm in each location is not plastered with cement mortar 1:3 (1cement: 3 fine sand) 6 mm thick, necessary deduction shall be made for plastering not done.

(d) The surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the shuttering is removed, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done by hacking. Before the surface is plastered, it shall be cleaned and wetted so as to give bond between concrete and plaster. RCC work shall be done carefully so that the thickness of plaster required for finishing the surface is not more than 6 mm.

(e) The surface of RCC slab on which the cement concrete or mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done without disturbing the concrete.

5.7 PRECAST CEMENT CONCRETE JALI

5.7.1 The jali shall be of cement concrete 1:2:4 (1 cement 2 coarse sand: 4 stone aggregate 6 mm nominal size) reinforced with 1.6 mm thick mild steel wire, unless otherwise specified.

5.7.2 Fixing

The jali shall be set in position true to plumb and level before the joints sills and soffits of the openings are plastered. It shall then be properly grouted with cement mortar 1:3 (1 cement: 3 coarse sand) and rechecked for levels. Finally the jambs, sills and soffits shall be plastered embedding the jail uniformly on all sides.

5.8 DESIGN MIX

5.8.1 Definition: Design mix concrete is that concrete in which the design of mix i.e. the determination of proportions of cement, aggregate & water is arrived as to have target mean strength for specified grade of concrete. The minimum mix of M25 shall be used in all structural elements in both load bearing & RCC framed construction.

5.8.2 Mix Design and Proportioning

5.8.2.1 Mix proportions shall be designed to ensure that the workability of fresh concrete is suitable for conditions of handling and placing, so that after compaction it surrounds all reinforcement and completely fills the formwork. When concrete is hardened, it shall have the stipulated strength, durability and impermeability.

5.8.2.2 Determination of the proportions by weight of cement, aggregates and water shall be based on design of the mix.

5.8.2.3 As a trial the manufacturer of concrete may prepare a preliminary mix according to provisions of SP: 23. Reference may also be made to ACI 211.1-77 for guidance.

5.8.2.4 Mix design shall be tried and the mix proportions checked on the basis of tests conducted at recognized laboratory approved by the Engineer-in-Charge.

5.8.2.5 All concrete proportions for various grades of concrete shall be designed separately and the mix proportions established keeping in view the workability for various structural elements, methods of placing and compacting.

5.8.2.6 Before using an admixture in concrete, its performance shall be evaluated by comparing the properties of concrete with the admixture and concrete without any admixture. Chloride content of admixture should be declared by the manufacturer of admixture and shall be within limits stipulated by IS:9103.

5.8.3 Standard Deviation

5.8.3.1 Standard deviation calculations of test results based on tests conducted on the same mix design for a particular grade designation shall be done in accordance with IS 456.

5.8.4 Acceptance Criteria

5.8.4.1 Compressive Strength:

The concrete shall be deemed to comply with the strength requirements when both the following condition are met:

(a) The mean strength determined from any group of four consecutive test results complies with the appropriate limits in col 2 of Table 5.6(CPWD specification vol 1 2009 chapter 5)

(b) Any individual test result complies with the appropriate limits in col. 3 of Table 5.6(CPWD specification vol 1 2009 chapter 5)

5.8.4.2 Flexural Strength:

When both the following conditions are met, the concrete complies with the specified flexural strength.

(a) The mean strength determined from any group of four consecutive test results exceeds the specified characteristic strength by at least 0.3 N/mm2

(b) The strength determined from any test result is not less than the specified characteristic strength0.3 N/mm2.

5.8.4.3 Quantity of Concrete Represented by Strength Test Results:

The quantity of concrete represented by a group of four consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches .Only the particular batch from which the sample was taken shall be at risk. Where the mean rate of sampling is not

specified the maximum quantity of concrete that four consecutive test results represent shall be limited to 60 m3.

5.8.4.4 If the concrete is deemed not to comply pursuant to 5.8.3 CPWD specification vol 1 2009 the structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken.

5.8.4.5 Concrete of each grade shall be assessed separately.

5.8.4.6 Concrete is liable to be rejected if it is porous or honey-combed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the tolerances specified, or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measured to the satisfaction of the Engineer-in-Charge.

5.8.4 Cement Content of Concrete

5.8.4.1 For all grades of concrete manufactured/produced, minimum cement content in the concrete shall be 330 kg per cubic metre of concrete. Also, irrespective of the grade of concrete the maximum cement content shall not be more than 500 kg per cubic metre of concrete. These limitations shall apply for all types of cements of all strengths.

5.8.5 Water Cement Ratio and Slump

5.8.5.1 In proportioning a particular mix, the manufacturer/ producer/ contractor shall give due consideration to the moisture content in the aggregates, and the mix shall be so designed as to restrict the maximum free water cement ratio to less than 0.5.

5.8.5.2 Due consideration shall be given to the workability of the concrete thus produced. Slump shall be controlled on the basis of placement in different situations. For normal methods of placing concrete, maximum slump shall be restricted to 100 mm when measured in accordance with IS 1199.

5.8.6 Approval of Design Mix

5.8.6.1 The producer/ manufacturer/ contractor of concrete shall submit details of each trial mix of each grade of concrete designed for various workability conditions to the Engineer-in-Charge for his comments and approval. Concrete of any particular design mix and grade shall be produced/manufactured for works only on obtaining written approval of the Engineer-in-Charge.

5.8.6.2 For any change in quality/ quantity in the ingredients of a particular concrete, for which mix has-been designed earlier and approved by the Engineer-in-Charge, the mix has to be redesigned and approval obtained again.

5.9 READY MIXED CONCRETE :(as per IS 4926)

5.9.1 Materials

5.9.1.1 Selection and Approval of Materials: Materials used should satisfy the requirements for the safety, structural performance durability and appearance of

the finished structure, taking full account of the environment to which it will be subjected. The selection and use of materials shall be in accordance with IS 456. Materials used shall conform to the relevant Indian Standards applicable. Where materials are used which are not covered by the provisions of the relevant Indian Standard, there should be satisfactory data on their suitability and assurance of quality control. Records and details of performance of such materials should be maintained. Account should be taken of possible interactions and compatibility between IS 4926 and materials used. Also, prior permission of the purchaser shall be obtained before use of such materials.

5.9.1.2 Cement:

Cement used for concrete shall be in accordance with the requirements of IS 456.

5.9.1.3 Mineral Admixtures:

Use of mineral admixtures shall be permitted in accordance with the provisions of IS 456.

5.9.1.4 Aggregates:

Aggregates used for concrete shall be in accordance with the requirement of IS456. Unless otherwise agreed testing frequencies for aggregates in plant shall be as given IS 4926.

5.9.1.5 Chemical Admixtures

(i) Use of chemical admixtures shall be permitted in accordance, with the provisions of IS 456 and IS 9103.

(ii) It shall be the responsibility of the producer to establish compatibility and suitability of any admixture with the other ingredients of the mix and the determine the dosage required to give the desired effect.

(iii) Admixtures should be stored in a manner that prevents degradation of the product and consumed within the time period indicated by the admixture supplier. Any vessel containing an admixture in the plant or taken to site by the producer shall be clearly marked as to its content.

(iv) When offering or delivering a mix to a purchaser it should be indicated if such a mix contains an admixture or combination of admixtures or not. The admixtures may be identified generically and should be declared on the delivery ticket.

(v) The amount of admixture added to mix shall be recorded in the production record. In special circumstances, if necessary, additional dose of admixture may be added at project site to regain the workability of concrete with the mutual agreement between the producer and the purchaser.

5.9.1.6 Water:

Water used shall be in accordance with the requirement of IS 456.

5.10 PLACING CONCRETE BY PUMPING:

Concrete conveyed by pressure through either rigid pipes or flexible hoses and discharged directly into the desired area is termed as pumped concrete. Method

of applying pressure to concrete is by pumps. Pumps to be used shall be either of the two types as mentioned below:-

(A) Piston type pumps

(B) Squeeze pressure type pumps.

Compressed air pressure pumps shall not be used in the works.

6.1 BRICK WORK: List of Bureau of Indian Standards Codes

S.No.	IS. Codes.	Subject
1.	IS712	Specification for building limes.
2.	IS1077	Common burnt clay building bricks.
3.	IS1200(Part3)	Method of measurements of brick works
4.	IS2212	Code of practice for brick work. (1st Revision)
5.	IS2222	Specification for burnt clay perforated building bricks
6.	IS2849	Specification for non-load bearing gypsum partition blocks, (Solid and hollow types)
7.	IS3495	Method of test for burnt clay building bricks.
8.	IS3812	Specification for fly ash for use as pozzolana and
9.	IS4139	Specification of calcium silicate bricks
10.	IS4885	Specification for sewer brick
11.	IS5454	Methods of sampling of clay building bricks
12.	IS12894	Pulverized fuel ash lime bricks specification,
13.	IS13757	Specification of burnt clay fly ash bricks

6.2 Classification

The brick work shall be classified according to the class designation of bricks used.

6.3 Mortar

The mortar for the brick work shall be as specified, and conform to accepted standards. Lime shall not be used where reinforcement is provided in brick work.

6.4 Soaking of Bricks

Bricks shall be soaked in water before use for a period for the water to just penetrate the whole depth of the bricks. Alternatively bricks may be adequately soaked in stacks by profusely spraying with clean water at regular intervals for a period not less than six hours. The bricks required for masonry work using mud mortar shall not be soaked. When the bricks are soaked they shall be removed from the tank sufficiently early so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on clean place where they are not again spoiled by dirt earth etc.

6.5 Laying

6.5.1 Bricks shall be laid in English Bond unless otherwise specified. For brick work in half brick wall, bricks shall be laid in stretcher bond. Half or cut bricks shall not be used except as closer where necessary to complete the bond. Closers in such cases, shall be cut to the required size and used near the ends of the wall. Header

bond shall be used preferably in all courses in curved plan for ensuring better alignment.

6.5.2 All loose materials, dirt and set lumps of mortar which may be lying over the surface on which brick work is to be freshly started, shall be removed with a wire brush and surface wetted. Bricks shall be laid on a full bed of mortar, when laying, each brick shall, be properly bedded and set in position by gently pressing with the handle of a trowel. It's inside face shall be buttered with mortar before the next brick is laid and pressed against it. Joints shall be fully filled and packed with mortar such that no hollow space are left inside the joints.

6.5.3 The walls shall be taken up truly in plumb or true to the required batter where specified. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in the alternate course shall come directly one over the other. Quoin, Jambs and other angles shall be properly plumbed as the work proceeds. Care shall be taken to keep the perpends properly aligned within following maximum permissible tolerances:

(a) Deviation from vertical within a storey shall not exceed 6 mm per 3 m height.

(b) Deviation in verticality in total height of any wall of building more than one storey in height shall not exceed 12.5 mm.

(c) Deviation from position shown on plan of any brick work shall not exceed 12.5 mm.

(d) Relative displacement between load bearing wall in adjacent storey's intended to be vertical alignments shall not exceed 6 mm.

(e) A set of tools comprising of wooden straight edge, Masonic spirit levels, square, 1 metre rule line and plumb shall be kept on the site of work for every 3 masons for proper check during the progress of work.

6.5.4 All quoins shall be accurately constructed and the height of brick courses shall be kept uniform. This will be checked using graduated wooden straight edge or storey rod indicating height of each course including thickness of joints. The position of damp proof course, window sills, bottom of lintels, top of the wall etc. along the height of the wall shall be marked on the graduated straight edge or storey rod. Acute and obtuse quoins shall be bonded, where practicable in the same way as square quoins Obtuse quoins shall be formed with squint showing three quarters brick on one face and quarter brick onthe other.

6.5.5 The brick work shall be built in uniform layers. No part of the wall during its construction shall rise more than one metre above the general construction level. Parts of wall left at different levels shall be raked back at an angle of 45 degrees or less with the horizontal. Toothing shall not be permitted as an alternative to raking back. For half brick partition to be keyed into main walls, indents shall be left in the main walls.

6.5.6 All pipe fittings and specials, spouts, hold fasts and other fixtures which are required to be built into the walls shall be embedded, as specified, in their correct position as the work proceeds unless otherwise directed by the Engineer-in-Charge.

6.5.7 Top courses of all plinths, parapets, steps and top of walls below floor and roof slabs shall be laid with brick on edge, unless specified otherwise. Brick on edge laid in the top courses at corner of walls shall be properly radiated and keyed into position to form cut (maru) corners as shown in Fig 6.4. Where bricks cannot be cut to the required shape to form cut (maru) corners, cement concrete 1:2:4 (1 cement :2 coarse sand : 4 graded stone aggregate 20 mm nominal size) equal to thickness of course shall be provided in lieu of cut bricks.

6.5.8 Bricks shall be laid with frog (where provided) up. However, when top course is exposed, bricks shall be laid with frog down. For the bricks to be laid with frog down, the frog shall be filled with mortar before placing the brick in position.

6.5.9 In case of walls one brick thick and under, one face shall be kept even and in proper plane, while the other face may be slightly rough. In case of walls more than one brick thick, both the faces shall be kept even and in proper plane.

6.5.10 to facilitate taking service lines later without excessive cutting of completed work, sleeves (to be paid separately) shall be provided, where specified, while raising the brick work. Such sleeves in external walls shall be sloped down outward so as to avoid passage of water inside.

6.5.11 Top of the brickwork in coping and sills in external walls shall be slightly tilted. Where brick coping and sills are projecting beyond the face of the wall, drip course/throating (to be paid separately) shall be provided where indicated.

6.5.12 Care shall be taken during construction that edges of jambs, sills and projections are not damaged in case of rain. New built work shall be covered with gunny bags or tarpaulin so as to prevent the mortar from being washed away. Damage, if any, shall be made good to the satisfaction of the Engineer-in-Charge.

6.5.13 Vertical reinforcement in the form of bars (MS or high strength deformed bars or thermo mechanically treated bars as per direction of Engineer-in-Charge), considered necessary at the corners and junction of walls and jamb opening doors, windows etc. shall be encased with cement mortar not leaner than 1:4 (1 cement : 4 coarse sand), or cement concrete mix as specified. The reinforcement shall be suitably tied, properly embedded in the foundation and at roof level. The dia. of bars shall not be less than 8 mm and concrete grade shall be minimum 1:3:6 (1cement: 3coarse sand: 6 graded stone aggregate 20 mm nominal size).

6.5.14 In retaining walls and the like, where water is likely to accumulate, weep holes, 50 to 75 mm square shall be provided at 2 m vertically and horizontally unless otherwise specified. The lowest weep hole shall be at about 30 cm above the ground level. All weep holes shall be surrounded by loose stones and shall have sufficient fall to drain out the water quickly.

6.5.15 Work of cutting chases, wherever required to be made in the walls for housing G.I. pipe, CI pipe or any other fixtures shall be carried out in various locations as per guidelines given below:

(a) Cutting of chases in one brick thick and above load bearing walls.

(i) As far as possible services should be planned with the help of vertical chases. Horizontal chases should be avoided.

(ii) The depths of vertical chases and horizontal chases shall not exceed one-third and one-sixth of the thickness of the masonry respectively.

(iii) When narrow stretches of masonry (or short length of walls) such as between doors and windows, cannot be avoided they should not be pierced with openings for soil pipes or wastepipes or timber joints, etc. Where there is a possibility of load concentration such narrow lengths of walls shall be checked for stresses and high strength bricks in mortar or concrete walls provided, if required.

(iv) Horizontal chases when unavoidable should be located in the upper or lower one- third of height of storey and not more than three chases should be permitted in any stretch of a wall. No continuous horizontal chase shall exceed one metre in length. Where unavoidable, stresses in the affected area should be checked and kept within the permissible limits.

(v) Vertical chases should not be closer than 2 m in any stretch of a wall. These shall be kept away from bearings of beams and lintels. If unavoidable, stresses in the affected area should be checked and kept within permissible limits.

(vi) Masonry directly above a recess, if wider than 30 cm horizontal dimension) should be supported on lintel. Holes in masonry may be provided upto 30 cm

width and 30 cm height without any lintel. In the case of circular holes in the masonry, no lintel need be provided foxholes up to 40 cm in diameter.

(b) Cutting of chases in half brick load bearing walls. No chase shall be permitted in half brick load bearing walls and as such no recessed conduits and concealed pipes shall be provided with half brick thick load bearing walls.

(c) Cutting of chases in half brick non-load bearing wall: Services should be planned with the help of vertical chases. Horizontal chase should be provided only when unavoidable.

6.6 Joints

The thickness of all types of joints including brick wall joints and cross joints shall be such that four course and three joints taken consecutively shall measure as follows:

(i) In case of modular bricks conforming to IS 1077 specification for common burnt clay buildings bricks, equal to 39 cm.

(ii) In case of non-modular bricks, it shall be equal to 31 cm.

Specified thickness of joints shall be of 1 cm. Deviation from the specified thickness of all joints shall not exceed one-fifth of specified thickness.

6.6.1 Finishing of Joints:

The face of brick work may be finished flush or by pointing. In flush finishing either the face joints of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work or the joints shall be squarely raked out to a depth of 1 cm while the mortar is still green for subsequently plastering. The faces of brick work shall be cleaned with wire brush so as to remove any splashes of mortar during the course of raising the brick work. In pointing, the joints shall be squarely raked out to a depth of 1.5 cm while the mortar is still green and raked joints shall be brushed to remove dust and loose particles and well wetted, and shall be later refilled with mortar to give ruled finish. Some such finishes are ‘flush’, ‘weathered’, ruled, etc.

6.7 Curing

The brick work shall be constantly kept moist on all faces for a minimum period of seven days. Brickwork done during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

7.1 STONE WORK: List of Bureau of Indian Standard Codes

S. No.	IS Code No.	Subject
1.	IS737	Specifications for wrought aluminium and aluminium alloy, Steel and strip for general engineering purpose.
2.	IS1121(Pt.I)	Methods of determination of properties and strengths of natural building stones (Part-I compressive strength).
3.	IS1122	Methods for determination of specific gravity of natural building stone
4.	IS1123	Methods of identification of natural building stones
5.	IS1124	Methods of test of determination of water absorption, Apparent, specific gravity and porosity of natural building stones.
6.	IS1125	Methods of test of determination of weathering of natural building stone
7.	IS1126	Methods of test for determination of durability of natural building stone
8.	IS1128	Specification for Lime stone (Slab & Tiles)
9.	IS1129	Recommendations for dressing of natural building stones
10.	IS1200(Pt.IV)	Methods of measurements of building and Civil engineering works stone Masonry
11.	IS1197(Pt.I)	Code of practice for construction of rubble stone masonry
12.	IS1597(Pt.II)	Code of practice for construction of ashlars stone masonry
13.	IS1805	Glossary of terms relating to stones, quarrying and dressing
14.	IS3620	Specification for latrite stone block for masonry
15.	IS3622	Sand stone (Slab & Tiles)
16.	IS4104(Pt.I)	Code of practice for external facings and veneers (Part I-Stone facing).
17.	IS4101(PartII)	Code of practice for external facing and veneers: (Part II-Cement Concrete facing)

8.1 MARBLEWORK: List of Bureau of Indian Standards Codes

S. No.	IS. Codes.	Subject
1.	IS 1122	Method of test for determination of true specific gravity of natural building stones.

2.	IS 1124	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones.
3.	IS 1130	Marble (blocks, slabs and tiles).
4.	IS 4101 (Part 1)	Code of practice for external facing and veneers: Stone facing.
5.	IS 3316	Specifications for structural granite
6.	IS 14223 (Part 1)	Polished Building Stones (Part-1) Granite

Marble shall be hard, sound, dense and homogeneous in texture with crystalline texture as far as possible. It shall generally be uniform in colour and free from stains, cracks, decay and weathering.

Marbles are metamorphic rocks capable of taking polish, formed from the re-crystallization of limestone's or dolomite lime stones and are distinguished from lime stone by even visibly crystalined nature and non-flaggy stratification.

8.2 CLASSIFICATION

The marble blocks, slabs and tiles shall be classified broadly in the following two categories:

8.2.1 White Marble

Raj Nagar (plain white) Marble: It shall be plain white marble with coarse grains predominantly showing mica particles giving reflection in light.

8.2.2 Coloured Marble

(i) Plain Black Marble: Black marble sawn along veins locally known as 'PetaPasu sawing' available at Bhainslana.

(ii) Black Zebra Marble:

(a) Bhainslana Black Zebra Marble: Black marble having grey or white veins available at Bhainslana.

(b) Kishangarh Black Zebra Marble: Black marble with grey and/or white veins available at Kishangarh.

(c) Abu Black Zebra Marble: Black marble having white patches and streaks available at Abu.

(d) Narnaul Black Zebra Marbles: Black marble with thin white veins available at Narnaul.

(e) Makrana Dhobi Doongri Zebra Marble: Greyish black marble with white flowery pattern available at Dhobi Doongri.

(iii) Green Marble

(a) Baroda Green Marble: Dark green marble with flowery pattern available at Baroda.

(b) Abu Green Marble: Light green marble with green and/or brown streaks on white ground available at Ambaji.

(c) Falna Green Marble: Green marble with prominent yellowish pattern available at Falna.

(d) Bundi Green Marble: Green marble with pinkish shades available at Umar, (Bundi).

(iv) Grey Marble

(a) Kumari Grey Marble: Grey marble having light blue shades available at Makrana.

(b) Bundi Grey Marble: Grey Marble with pink or green or black streaks available at Umar (Bundi).

(v) Brown Marble

(a) Bar Brown Marble/Brown Marble with light and dark brown shades available at Bar.

(b) Narnaul Brown Marble:Brown marble having teak wood shades available at Narnaul.

8.2.3 Granite Stone

It shall be of any color and size as directed by Engineer-in-Charge. Granite shall be plain machine cut and mirror polished. The stone shall be smooth and of even surface without holes or pits.

8.3 MARBLE WORK - TABLE RUBBED AND POLISHED (PLAIN WORK)

Marble work in steps, jambs, columns and other plain work shall be as specified below: Joints in staircase treads, kitchen platforms shall be permitted only at curvature or when width/length is more than 0.6/2 mtrs. Respectively. Number of joints in each direction shall not be more than one number for every 2 mtrs. Length beyond the initial 2.00 m length. Additional joints due to curvature or for providing fixture shall be provide judiciously

8.3.1 Dressing, Cutting and Rubbing

Every marble stone shall be gang saw/machine cut to the required size and shape, chisel dressed machine finished on all beds and joints, so as to be free from any waviness and to give truly vertical, horizontal, radial or circular joints as required. The exposed faces and sides of stones forming joints upto 6mm. from the face shall be fine tooled machine cut such that a straight edge laid along the face of the stone is in contact with every point on it. All window sills, tread of steps, counters vanities moulding edges etc. shall be machine cut & polished to give high gloss mirror finish as per direction of Engineer-in- Charge. These surfaces shall then be rubbed smooth. All visible angles and edges shall be true, square and free from chipping. Beyond the depth of 6 mm from face, the joints shall be dressed with a slight splay so that the thickness of joint increases, in an inverted V shape the surfaces of the stones coming in contact with backing need not be chisel dressed. A sample of dressed and rubbed stone shall be prepared for approval and it shall be kept on worksite after being approved by the Engineer-in Charge.

8.3.2 Mortar

The mortar used for jointing shall be as specified.

8.3.3 Laying

All marble stones shall be wetted before placing in position. These shall then be floated on mortar and bedded properly in position with wooden mallets without the use of chips or under pinning of any sort. The walls and pillars shall be carried up truely in plumb or battered as shown in the drawings. All courses shall be laid truely horizontal and all vertical joints shall be truely vertical. In case of work without backing of brick work or coursed rubble masonry, face stone shall be laid in headers and stretchers alternatively unless otherwise directed. The headers shall be arranged to come as nearly as possible in the middle of stretchers above and below. Stone shall be laid in regular courses of not less than 15 cm in height and all courses shall be of the same height unless otherwise specified. For work facing with backing of brick work or coursed rubble masonry, face stone shall be laid in alternate courses of header and stretchers unless otherwise directed. Face stone and bond stone courses shall have break joint on the face of atleast half the height of the standard course and the bond shall be carefully maintained throughout. All the connected masonry in a structure shall be carried up nearly at one uniform level throughout but where breaks are unavoidable the joints shall be made in good long steps so as to prevent cracks developing between new and old work. When necessary jib crane or other mechanical appliances shall be used to hoist the heavy pieces of stones and place these in to correct positions, care being taken that the corners of the stone are not damaged. Stone shall be covered with gunny bags, before putting chain or rope is passed over it, and it shall be handled carefully. No piece which has been damaged shall be used in work. The matching of grains shall be carried out as directed by the Engineer-in-Charge.

8.3.4 Bond Stone

Bond or through stones running right through the thickness of walls, shall be provided in walls upto 60 cm thick and in case of wall above 60 cm thickness a set of two or more bond stones overlapping each other by atleast 15 cm shall be provided in a line from face to back. At least one bond stone or a set of bond stones shall be provided for every 0.5 sqm of the wall surface. All bond stones shall be marked suitably as directed by the Engineer-in-Charge.

8.3.5 Joints

The depth of joints 6 mm from the face shall be uniform and as fine as possible but shall be not more than 1.5 mm thick on the exposed face. Beyond the depth of 6 mm from face, the thickness of joints shall increase in an inverted V shape so

as to give good mortar bond between two stones. The inverted portion of the joints shall be filled with bedding mortar and the face 6 mm portion with pointing mortar.

8.3.6 Curing

The work shall be kept constantly moist on all faces for a period of atleast seven days.

8.3.7 Finishing

After the marble work is cured, it shall be rubbed with carborandum stone of different grades no. 60,120 and 320 in succession or with electrical rubbing machines rubbed with carborandum items 0 to 6 nos.in successions, so as to give a plane true and highly smooth surface. It shall then be cleaned with a solution of oxalic acid, washed and finished clean.

8.3.8 Protection

Green work shall be protected from rain by suitable coverings. The work shall also be suitably protected from damage during construction.

8.3.9 Scaffolding

Double scaffolding having two sets of vertical supports shall be provided where necessary. The supports shall be sound and strong, tied together by horizontal pieces over which the scaffolding plank shall be fixed.

8.4 WALL LINING/VENEER WORK

8.4.1 The marble slabs used for wall lining/veneer work shall be gang saw cut (polished & machine cut) back shall not be polished/ cut in order to ensure a good grip with the hearting of backing. The cut slabs shall be of the thickness as specified with a tolerance permissible. The tolerance in wall lining when straight edge of 3 m length is placed should not be more than 2 mm

8.4.2 Laying

The stone shall be wetted before laying. They shall then be fixed with mortar in position without the use of chips or under pinning of any sort. Care shall be taken to match the grains of veneer work as directed by the Engineer-in-Charge. For purpose of matching the grains, the marble slabs shall be selected judiciously having uniform pattern of veins/streaks. Preferably the slabs shall be those got out of the same block from the quarry. The area to be veneered shall be reproduced on the ground and the marble slabs laid in position and arranged in the manner to give the desired matching of grains. Any adjustment needed for achieving the best results shall be then carried out by replacing or interchanging the particular slabs. Special care shall be taken to achieve the continuity of grains between the two slabs one above the other along the horizontal joints. This shall then be got approved by the Engineer-in-Charge and each marble slabs numbered properly and the same number shall be marked on a separate drawing as well as on the surface to be actually veneered, so as to ensure the fixing of the particular slabs in the correct location.

8.4.2.1 Where so desired, the adjoining stones shall be secured to each other by means of copper pins 75 mm long and 6 mm diameter or as specified.

8.4.2.2 The stones shall be secured to the backing by means of cramps. The material for cramps shall have high resistance to corrosion under conditions of dampness and against the chemical action of mortar or concrete in which cramps are usually embedded. Cramps shall be of 25 × 6 mm and 30 cm long in case of backing of stone masonry walls and brick masonry walls thicker than 230 mm. In case of backing with brick masonry walls 230 mm or less thick or RCC member's cramps shall be of 25 × 6 mm and length as per requirement made out of gun metal or any other metal. Generally the outer length of cramp in half brick work backing shall be 115 mm and in one brick work backing it shall be 150 mm. Typical shape & details of cramps for such backing are as indicated in Fig. 8.2 for general guidance. This can be modified as directed by the Engineer-in-Charge if so, required at site. Cramps shall be spaced not more 60 cm apart horizontally. Alternatively the stone may be secured to the backing by means of stone dowels 10 x 5 x 2.5 cm

8.4.2.3 The adjoining stones shall be secured to each other by means of gun metal cramps or copper pins of the specified size. Cramps may be attached to its sides or top and bottom(or sides, top and bottom) The general arrangement of cramps required for fixing facing unit to the wall The actual number of cramps and their sections, however, shall be as per requirements of design to carry the loads.

8.4.2.4 Where cramps are used to hold the unit in position only, the facings shall be provided with continuous support on which the stones rest at the ground level and other storey levels, the support being in the form of projection from or recess into the concrete floor slab, or a beam between the columns or a metal angle attached to the floor slab or beams. These supports shall preferably be at vertical intervals not more than 3.5 m apart and also over the heads of all openings. Such supports shall also be provided where there is transition from thin facing below to thick facings above.

8.4.2.5 Alternatively cramps may be used to hold the units in position and in addition to support the units thus transferring the weight of the units to the backing. Such cramps should be properly designed as per IS 4101 (Part 1).

8.4.2.6 The cramps may be of copper alloyed with zinc, tin, nickel, lead or stainless steel.

8.4.2.7 The pins, cramps and dowels shall be laid in cement mortar 1:2 (1 cement: 2 fine sand) and their samples got approved by the Engineer-in-Charge and kept at site.

8.4.3 Joints

All joints shall be full of mortar. Special care shall be taken to see that groundings for veneer work are full of mortar. If any hollow grounding are detected by tapping the face stones, these shall be taken out and re-laid. The thickness of the

face joints shall be uniform, straight and as fine as possible, not more than 1.5 mm and in the face joint, the top 6 mm depth shall be filled with mortar specified for the pointing.

8.4.4 Mortar

The mortar used for jointing slabs shall be as specified.

8.5 MARBLE STONE FLOORING AND MARBLE STONE IN RISERS OF STEPS AND SKIRTING

Refer to relevant clause in chapter 11.0 of flooring of CPWD Specifications vol.1 2009.

8.5.1 Marble Slab Urinal Partitions

The partitions shall be of marble slab embedded in the wall. The size and shape of the marbles slab shall be as per direction of Engineer-in-Charge. The finished thickness shall be 18 mm. The specifications for marble/granite stone work, in general, shall be as specified. The marble granite stone shall be cut into slabs of required thickness and shall be one piece.

8.5.2 Finishing

The partition of the slab to be embedded in the masonry shall be rough dressed. Dressing and rubbing of the exposed portion of the slab shall be as described. The dressed slab shall be of the thickness as specified with a tolerance of + 1.5mm. The slab shall be got approved from the Engineer-in- Charge before fixing.

8.5.3 Fixing shall be as specified except that the recess shall be 7.5 cm wide. Fixing shall be done by cutting chase with chase cutter/fine tools in a recess of 7.5 cm X 7.5 cm filled with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6mm nominal size). Fixing can also be done by epoxy grout in a chase of 2.0 X 7.5 cm as per direction of Engineer-in-Charge.

9.1 Wood Work: List of Bureau of Indian Standard Codes

S. No.	IS Codes	Subject
1	IS 204 (Part I)	Specification for tower bolts (ferrous bolt)
2	IS 204 (Part II)	Specification for tower bolts (nonferrous metals)
3	IS 205	Specification for nonferrous metal butt hinges
4	IS 206	Specification for Tee and strap hinges
5	IS 207	Specification for Gate and shutter hook and eye
6	IS 208	Specification for door handles
7	IS 281	Specification for mild steel door bolts for use with pad locks
8	IS 364	Specification for fan light catch
9	IS 419	Putty for use on window frames
10	IS 2096	Specification for asbestos cement flat sheet
11	IS 2209	Specification for mortice lock (Vertical Type)
12	IS 3087	Specification for wood particle boards (Medium density)
13	IS 3564	Specification for door closer (hydraulically regulated)
14	IS 4992	Specification for rebated mortice lock
15	IS 6607	Specification for rebated mortice lock (Vertical type)
16	IS 12817	Specification for stainless steel Butt Hinges

17	IS 14616	Specifications for laminated veneer lumber

9.2 TIMBER

As per CPWD specifications-

The timber shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, splits and cracks. The timber shall be graded as first grade and second grade on the basis of the permissible defects in the timber as given in Appendix 'A' of Chapter 9.0 of CPWD Specifications.

9.3 Non-Asbestos Fibre Boards

Fibre boards shall be of medium density cement board reinforced with wood fibre, produced by fiberizing steamed wood under pressure, blended with adhesive and wax and formed into solid panels under controlled conditions of heat and pressure as per IS 14862. The adhesive used for bonding shall be BWP type synthetic resin conforming to IS 848

9.4 Prelaminated Particle Boards

Prelaminated particle boards are available in two grades namely Grade I and II as per IS 12823.Each grade is further classified in four types; namely Type –I, II, III, IV Particle Board Prelaminated particle board Grade-1 (FPT–I or graded wood particle board FPT-I) bonded with BWP type synthetic resin and prelaminated conforming to IS 12823 Grade-I, type II or I shall be used.

9.5 PANELLED GLAZED OR PANELLED AND GLAZED SHUTTERS

9.5.1 Panelled or glazed shutters for doors, windows, ventilators and cupboards shall be constructed in the form of timber frame work of stiles and rails with panel inserts of timber, plywood, block board, veneered particle board, fibre board wire gauze or float glass. All members of the shutters shall be straight without any warp or bow and shall have smooth well planned face at right angles to each other.

9.5.2 Any warp or bow shall not exceed 1.5 mm for door shutter and 1 mm for window and ventilator shutters. Generally panelled glazed or panelled and glazed shutter shall conform to IS 1003.

9.5.3 Frame Work

The stiles and rails shall be joined to each other by plain or haunched mortise and tenon joints and the rails shall be inserted 25 mm short of the width of the stiles. The bottom rails shall have double tenon joints and for other rails single tenon joints shall be provided. The lock rails of door shutter shall have its centre line at a height of 800 mm from the bottom of the shutters unless otherwise specified.

9.5.4 Rebating

The shutters shall be single-leaf or double leaved as shown in the drawings or as directed by the Engineer-in-Charge. In case of double leaved shutters, the meeting of the stiles shall be rebated by one third the thickness of the shutter. The rebating shall be either splayed or square type.

9.5.5 Panelling

The panel inserts shall be either framed into the grooves or housed in the rebate of stiles and rails. The depth of the groove shall be 12 mm and its width shall accommodate the panel inserts such that the faces are closely fitted to the sides of the groove. Panel inserts shall be framed into the grooves of stiles and rails to the full depth of the groove leaving space of 1.5 mm. W idth and depth of the rebate shall be equal to half the thickness of stiles and rails.

9.5.6 Fixing of Shutters

For side hung shutters of height upto 1.2 m, each leaf shall be hung on two hinges at quarter points and for shutter of height more than 1.2 m, each leaf shall be hung on three hinges one at the centre and the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the centre of the frame. Size and type of hinges and pivots shall be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 mm shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutter of more than 40 mm thickness butt hinges of size 125 × 90 × 4 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified.

9.5.7 Fittings

9.5.7.1 Fittings shall be provided as per schedule of fittings decided by Engineer-in-Charge. Fitting shall be of mild steel brass, aluminium or as specified. Some mild steel fittings may have components of cast iron. These shall be well made, reasonably smooth, and free from sharp edges and corners, flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. These shall be of the following types according to the material used.

9.5.7.2 Types:

(a) Mild Steel Fittings: These shall be bright finish black stone enamelled or copper oxidised (black finish), nickel chromium plated or as specified.

(b) Brass Fittings: These shall be finished bright satin finish or nickel chromium plated or copper oxidised or as specified.

(c) Aluminium Fittings: These shall be anodised to natural matt finish or dyed anodic coating not less than grade AC 10 of IS 1868.

9.6 Tower Bolts

9.6.1 These shall generally conform to IS 204 (Part. I) & IS 204 (Part. II). Tower bolts shall be well made and shall be free from defects. The bolts shall be finished to

the correct shape and shall have smooth action. All sharp edges and corners shall be removed and finished smooth.

9.6.2 Aluminium barrel tower bolts with barrel and bolt of extruded sections of aluminium alloy. The knob shall be properly screwed to the bolt and riveted at the back. Aluminium alloy tower bolts (type 6) Bolt and barrel anodized.

9.7 Door Latch

9.7.1 This shall be of mild steel, cast brass, or as specified and shall be capable of smooth sliding action. In case, of mild steel latch, it shall be copper oxidized (black finish) or as specified and in case of brass, it shall be finished bright, chromium plated or oxidized or as specified. The size of door latch shall be taken as the length of the latch.

9.8 Door Handles (Doors and Windows)

9.8.1 The door handles shall be well made and free from defects. Cast handle shall be free from casting defects. Where the grip portion of the handle is joined with the base piece by mechanical means, the arrangement shall be such that the assembled handle shall have adequate strength comparable to that of integrally cast type handles.

9.8.2 Cast or Sheet Aluminium Alloy Handles: These shall be of aluminium of specified size, and of shape and pattern as approved by the Engineer-in-Charge. Aluminium handles, shall be anodized and the anodic coating shall not be less than grade AC 15– IS 1868 as specified. The finish can be bright natural, matt or satin or dyed as specified.

9.9 Floor Door Stopper

The floor door stopper shall conform to IS 1823. This shall be made of cast brass of overall size as specified and shall have rubber cushion. The shape and pattern of stopper shall be approved by the Engineer-in-Charge. Aluminium stopper shall be anodised and anodic film shall not be less than grade AC-10 of IS 1868.

9.10 P.T.M.T (Polytetra MethylineTetraphthalate) Fittings

9.10.1 PTMT (Polytetra Methylene Tetraphthalate) is an engineering plastic (raw material imported) P.T.M.T. fitting shall be in different colours like White, Green, Blue, Derby Brown, Mushroom, Black, Gold, Silver & Broonze or any colours agreed by the manufactures and purchaser. P.T.M.T. fittings are suitable for internal doors shutters kitchen, bath w.c. & cabinet etc. These shall not be used in external door and where security is concern. Screws used for fittings shall be counter sunk cross head of chromium plated brass or stainless steel. Sizes of screws shall be of same size as used in case nonferrous material door/window fittings.

9.10.2 P.T.M.T. Butt Hinges:

These shall be of required colour/shade ceramic look, glassy smooth surface. These shall be of required size and thickness.

9.10.3 P.T.M.T. Door Handles: The door handles shall be of material as mentioned above moulded to required shape and size. The size & thickness etc. of the handle shall be determined by the inside grip of the handle. These shall be moulded as solid sections. The body of the handle shall not be hollow.

9.10.4 PTMT Tower Bolt: The tower bolt shall be generally barrel type of material moulded to required shape and size. Size (length, dia, length of rod, number of holes) shall generally confirm to IS 204 PI &P-II. The rod shall be solid. If it in hollow it shall be provided with stainless steel rod of required dia. for its strength protective coat of wood primer, polish or varnish.

9.11 UPVC- DOOR FRAMES

9.11.1 Material

Polyvinyl chloride Resin suspension grade is the basic raw material for forming PVC compound. PVC resin then is mixed with chemicals like Calcium, Stearate, Hydrocarbon Wax, Titanium Dioxide, Calcium Carbonate, and Acrylic processing aids. Further, additives like impact modifiers, pigments, epoxy plasticizer, UV stabilizer, lubricants, chemical blowing agent etc. are added. The purpose of adding the chemicals and additives is to impart cellular structure, strength, surface finish, colour and resistance to fading by light rays. These chemicals are mixed in the desired proportion and shall be used in the formulation of PVC material and for free and smooth extrusion of PVC profiles.

9.11.2 UPVC Door Frame

UPVC door frame shall be made of PVC material conforming to IS 10151. The door frame shall be made from extruded UPVC section. Corners of the door frame to be joined by M.S. galvanized brackets. Joints mitred and plastic welded. The hinge side vertical outer frames shall be reinforced by galvanized M.S. Tube and a tie rod shall be provided at the bottom of the frame. The frame shall be fabricated in factory as per nomenclature of the item and directions of Engineer-in-Charge.

9.11.3 Fixing of Frames

The frames are to be fixed in prepared openings in the walls. All civil work and tiling should be completed before the fixing of the frames. The frames are to be fixed directly on the plastered wall. In case tiling is to be done in the place the frames are to be fitted, a 50 mm strip should be left untiled at the location where the frames are to be fitted. The frames are erected in the prepared opening such that the vertical members of the door frame are embedded 50 mm in the floor. The frame shall be fitted truly in plumb. A minimum of three anchor bolts or screws of size 65/100 shall be used to fix each vertical member. One bolt shall be fixed at 200 mm from the top member and one bolt shall be fixed at 200 mm from the floor. The third anchor bolt shall be fixed in the center. The top horizontal member shall be fixed using two 65/100 size anchor bolts or screws at a distance of 200 mm from both the corners.

9.12 PVC DOOR SHUTTERS

9.12.1 The shutters shall be fabricated at factory as per nomenclature of the item and directions of Engineer-in-Charge. Shutter shall be made of PVC material conforming to IS 10151.

9.12.2 General Precautions

The test specimens shall not have been exposed to a temperature below 40oC for 24 hours immediately preceding the test and shall be free from all visible moisture. The specimen shall be inspected and any specimen with visible flaws shall be discarded.

If any test specimen fails because of mechanical reason, such as failure of testing equipment or improper specimen preparation, it shall be discarded and another specimen taken.

9.12.3 Fixing of Shutters

PVC door shutter shall be side hung on three bolt hinges of size 100 mm, one at the centre and the other two at 200 mm from the top and bottom of the shutter. The flat of the hinges shall be neatly counter sunk in to the recesses cut out to the exact dimensions of the hinge flap. The door shall be drilled on the thickness to fit hinges. Screws for fixing the hinges shall be screwed in with screwdrivers and not hammered. The length of the screws should be 8 mm/30 mm. The hinges used should be of stainless steel.

9.12.4 Fittings:

Fittings shall be provided as per schedule of fittings decided by Engineer-in-Charge. In moisture prone areas M.S. fittings and screws should not be used. Hardware such as handles, tower bolt, stopper, buffer etc. should be directly screwed (not pre-drilled) and fitted on the door.

9.13 PVC DOOR FRAME

9.13.1 Solid PVC door frame and shutter shall be as per para 9.10.

The sheet used may be in plain colour, printed design or prelam veneer shade as approved by the Engineer-in-Charge. The weight per running metre of the door frame including reinforcement should be a minimum of 1.5 kg. /sq. mtr. The depth of the rebate of door frame shall be 10 mm. Frames shall have smooth surface, without any warping or bending in any member. All the parts of the door frame are to be joined to each other using solvent adhesive conforming to IS 14182.

The solid PVC door frames shall be fabricated in factory as per nomenclature of the item and directions of the Engineer-in-charge.

9.14 PANEL PVC DOOR SHUTTER

9.14.1 Panel PVC Shutters are factory made shutter and shall be brought to site fully assembled. The Solid Panel PVC Door shall be fabricated from 5 mm PVC sheet. The sheets used may be in plain colour, printed design or prelam veneer shade as approved by the Engineer-in-Charge. The shutters shall be fabricated at factory as per nomenclature of the item and directions of the Engineer-in-charge.

9.14.2 Fixing of Shutters

Already discussed above, in addition It may be ensured that while fixing hinges the screws pass through the two opposites surfaces of the M.S. reinforcement.

9.15 FIBRE GLASS REINFORCED PLASTIC (FRP) DOOR FRAMES

9.15.1 The frame shall be made of laminate of thickness of 2 mm and shall be filled with wooden blocks of exterior grade MDF or seasoned and treated hard wood inside the laminate in all the three legs of the frame. The frame to be moulded by either hand lay up or resin transfer moulding process. The process shall consist of laying gel coat at 1000 gms./m and laid over with layer of FRP Mat (CSM mat) gel coat and FRP (CSM Mat) are defined in IS 14856.

9.15.2 The CSM mat shall be bonded with Isophatholic resin in the ratio not less than 1:2 (One part of Mat to two parts of Isopathlic resin and fillers & additives) by weight. The edge shall be sealed with gel coat and FRP mat to obtain smooth finish. Sufficient roving shall be laid in the corner to have smooth curve while laying the CSM mat.

9.15.3 FRP door shall be manufactured as per specifications laid down in IS 14856, nomenclature of items& direction of Engineer-in-Charge.

9.16 FIBRE GLASS REINFORCED PLASTIC (F.R.P.) SHUTTERS

9.16.1 F.R.P. Shutters shall be manufactured conforming to the specifications as per IS 14856 and nomenclature of item & direction of Engineer-in-Charge.

9.16.2 Blocks of any seasoned hardwood of bulk density not less than 450 kg./m at 12 per cent moisture content or any other material of sufficient thickness and length shall be provided inside the shutter at suitable place to hold fittings and fixtures such as aldrops, tower bolt, handle, sliding door bolt, mortice lock etc. Blocks for hinges shall be provided at three locations, unless otherwise specified by the purchaser. One at the centre and other two at 200 mm from the top and the bottom of the shutter. Blocks shall be provided at predetermined places in the shutter so as to fix hinges mortice locks, tower bolts, aldrops, door closures, etc. The finished surface shall be buffed and polished with wax.

9.17 SOLID PVC FOAM PROFILE DOORS:

9.17.1 Solid PVC Foam Profile Frame

Solid PVC foam profile frame doors are made from solid PVC foam profiles 60 x 30 mm with integral skin cut to required size. Doors are provided with naturally strong stiffener frame and sandwich panelled to offer sound and heat insulation with pressure laminate/infill panel to provide scratch resistance surface. Supporting bar at bottom side of frame shall be provided for maintaining frame in plumb. The frame shall be fabricated in factory as per nomenclature of the item and directions of the Engineer-in-charge. PVC door frame should have shore hardness more than 70.

9.18 SOLID PVC FOAM SHUTTERS

Solid PVC foam shutters are made from solid PVC foam profiles with integral skin. Doors are provided with naturally strong stiffener frame and sandwich panelled to offer sound and heat insulation with pressure laminate/infill panel provides scratch resistance surface. Door shutters can be nailed, screwed, drilled, glued, sawn lapped or welded just like wood and characterized by excellent screw holding strength (200 kgf.).

9.18.1 28mm Thick Door Shutters

Profile is cut in required length to make vertical & horizontal stile. Mitered cut joint are made using solvent based PVC adhesive & epoxy solvent. GI 'C' stiffener 39x19x19 or 40x20x19 g. M.S. Pipe is fixed in the grooves made in frame. Telescopic polymeric corners are provided at corners for better rigidity. Infill panel 3 mm thick HPL sheet is fixed with csk screws of required size to the profile frame as specified. Mirror image of shutter frame is joined using solvent based PVC adhesive as well as csk type sheet metal screws of required size at four corners at top & bottom. Additional bonding strength is provided by using silicone sealant epoxy sealant at joints. Lock rail is provided by using PVC profile & 'C' type GI stiffener 40 x 10 in the groove & fixed with adhesive to frame & infill. Decorative corner moulding is fixed to impart elegant look.

9.19 DOOR, WINDOW AND VENTILATOR FRAMES/ FALSE CEILING

9.19.1 Timber for door, window and ventilators frames shall be as specified. Timber shall be sawn in the direction of the grains. All members of a frame shall be of the same species of timber and shall be straight without any warp or bow. Frames shall have smooth, well-planed (wrought) surfaces except the surfaces touching the walls, lintels, sill etc., which may be left clean sawn. Rebates, rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15 mm, and the width of the rebates shall be equal to the thickness of the shutters. A tolerance of ± 2 mm shall be permitted in the specified finished dimensions of timber sections in frames.

9.19.2 Joints

The Jamb posts shall be through tenoned in to the mortise of the transoms to the full thickness of the transoms and the thickness of the tenon shall be not less than 2.5 cm. The tenons shall closely fit into the mortise without any wedging or filling. The contact surface of tenon and mortise before putting together shall be glued with polyvinyl acetate dispersion based adhesive conforming to IS 4835 or adhesive conforming IS 851 and pinned with 10 mm dia hard wood dowels, or bamboo pins or star shaped metal pins. The joints shall be at right angles when checked from the inside surfaces of the respective members. The joints shall be pressed in position. Each assembled door frame shall be fitted with a temporary stretcher and a temporary diagonal brace on the rebated faces.

9.19.3 Fixing of Frames

The frames shall be got approved by the Engineer-in-Charge before being painted, oiled or otherwise treated and before fixing in position. The surface of the frames abutting masonry or concrete and the portions of the frames embedded in floors shall be given a coating of coal tar. Frames shall be fixed to the abutting masonry or concrete with holdfasts or metallic fasteners as specified. After fixing, the jamb posts of the frames shall be plugged suitably and finished neat. Vertical members of the doorframes shall be embedded in the floor for the full thickness of the floor finish and shall be suitably strutted and wedged in order to prevent warping during construction. A minimum of three hold fasts shall be fixed on each side of door and window frames one at centre point and other two at 30 cm from the top and bottom of the frames. In case of window and ventilator frames of less than 1 m in height two hold fasts shall be fixed on each side at quarter point of the frames. Hold fasts and metallic fasteners shall be measured and paid for separately.

10.1 Steel Work: List of Bureau of Indian Standard Codes

S. No.	IS No.	Subject
1	IS 63	Whiting for paints and putty
2	IS 228	Structural steel (Standard quality)
3	IS 800	Code of practice for use of structural steel in general in steel construction
4	IS 806	Code of practice for use of steel Tubes in general building construction
5	IS 812	Glossary of terms relating to welding and cutting metals
6	IS 817	Code of practice for training and testing of metal arc welders
7	IS 822	Code of procedure for inspection of welds
8	IS 823	Manual for metal arc welding in mild steel
9	IS 1038	Steel doors, windows and ventilators
10	IS 1200- (Pt. VIII)	Method of measurements of steel work and iron works
11	IS 1363 Part I	Haxagon head bolts, screws, and nuts of product grade C (Hexagon Head bolt)
12	IS 1363 Part II	Haxagon Head Bolts, screws and nuts of product Grade _C‘
13	IS 1363 Part-III	Haxagan Head Bolts, screws and Nuts of product grade _C‘
14	IS 1821	Dimensions for clearance holes for bolts and screws
15	IS 4351	Specification for steel door frames

10.2 STEEL WORK IN BUILT UP SECTIONS (RIVETED AND BOLTED)

10.2.1 Laying Out

A figure of the steel structure to be fabricated shall be drawn on a level platform to full scale. This may be done in full or in parts, as shown on drawings or as directed by the Engineer-in-Charge. Steel tape shall be used for measurements.

10.2.2 Fabrication

Fabrication shall generally be done as specified in IS 800. In major works or where so specified, shop drawings giving complete information for the fabrication of the

component parts of the structure including the location, type, size, length and details or rivets, bolts or welds, shall be prepared in advance of the actual fabrication and approved by the Engineer-in-charge.

10.2.3 Wooden or metal sheet templates shall be made to correspond to each member, and position of rivet holes shall be marked accurately on them and holes drilled. The templates shall then be laid on the steel members, and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting as per required dimensions.

10.2.4 The base of steel columns and the positions of anchor bolts shall be carefully set out at the required location. The steel section shall be straight or to be straightened or flattened by pressure unless required to be of curvilinear form and shall free from twists. These shall be cut square either by shearing or sawing to correct length and measured by steel tape. No two pieces shall be welded or joined to make up for the required length of member.

10.2.5 **Making Holes:** Holes through more than one thickness of materials for members, such as compound stanchion and girder flanges shall, where possible, be drilled after the members are assembled and tightly clamped or bolted together. Punching may be permitted before assembly, provided the holes are punched 3mm less in diameter than the required size and reamed after assembly to the full diameter. The thickness of material punched shall be not greater than 16 mm.

10.2.6 **Rivet Holes**

10.2.7 The diameter for rivets and black bolts holes shall be taken as the nominal diameter of a rivet/ black bolts plus 1.5 mm for rivets/ bolts of nominal diameter less than or equal to 25 mm‖ and 2.0 mm for rivets of nominal diameter exceeding 25 mm, unless specified otherwise. Holes for turned and fitted bolts shall be drilled or reamed large by 0.2 to 8 mm depending upon the dia. of bolts.

10.2.8 Holes shall have their axis perpendicular to the surface bored through. Holes for counter sunk bolts shall be made in such a manner that their heads sit flush with the surface after fixing.

10.2.9 **Assembly:**

Before making holes in individual members, for fabrication and steel work intended to be riveted or bolted together shall be assembled and clamped properly and tightly so as to ensure close abutting, or lapping of the surfaces of the different members.

10.2.10 **Riveting:**

Rivets shall be used, where slip under load has to be avoided.

10.2.11 Preliminaries before Riveting‘s:- Members to be riveted shall have all parts firmly placed and held together before and during riveting, and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

10.2.12 **Process of Riveting:**

The riveting shall be carried out by using machines of the steady pressure type. The rivets shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than10mm may be driven cold. Rivets shall be finished neat with heads full and of equal size. The heads shall be central on shanks and shall grip the assembled member‘s firmly. All rivets heads shall be painted with approved steel primer paint within a week of their fixing.

10.2.13 Bolting:

The nominal length of the bolt shall be the distance from the underside of the head to the further end of the shank. The nominal diameter of the bolt shall be the diameter at the shank above the screwed threads. Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil, before use. All bolts heads and nuts shall be hexagonal unless specified otherwise. The screwed threads shall conform to IS 1363 and the threaded surface shall not be tapered. The bolts shall be of such length as to project at least two clear threads beyond the nuts when fixed in position, and these shall fit in the holes without any shake. The nuts shall fit in the threaded ends of bolts properly.

10.2.14 Erection:

Steel members shall be hoisted and erected in position carefully, without any damage to itself, other structures and equipment and injury to workmen. The method of hoisting and erection proposed to be adopted by the contractor shall be got approved from the Engineer-in-charge in advance. During execution, the steel members shall be securely bolted or otherwise fastened when necessary temporarily braced to provide for all loads including those due to erection equipment‘s and its operation to be carried safely by structure during erection.

10.2.15 Bedding of Column, Stanchions etc.:-

Bedding shall not be carried out until the steel work has been finally levelled, plumbed and connected together. The stanchion shall be supported on steel wedges and adjusted to make the column plumb. The base plates shall be wedged clear of the bases by M.S. wedges and adjusted where necessary to plumb the columns. The gaps under the base plate may be made upto 25 mm which shall be pressure grouted with cement grouts. W ith small columns, ifpermitted by the Engineer-in-charge, the column base shall be floated on a thick cement grout on the concrete pedestal.

10.2.16 Painting

All surfaces which are to be painted, oiled or otherwise treated shall be dry and thoroughly cleaned to remove all loose scale and loose rust. This does not apply to the interior of sealed hollow sections. Part to be encased in concrete shall not be painted or oiled. A priming coat of approved steel primer such as Red Oxide/Zinc Chromate primer conforming to IS 2074 shall be applied before any member of steel structure are placed in position or taken out of workshop.

10.3 M.S. SHEET SHUTTERS

10.3.1 These shall be manufactured as per drawing and specification. These shall befabricated from mild steel sheets and angle iron. The doors shall be provided as double leaf shutters unless otherwise specified .The shutters shall be fabricated with frame and two diagonal braces. The frame shall be riveted and/ or welded at the junctions. Wherever riveting shall be done thick gusset plate shall be provided at the junction. M.S. sheet of 1 mm thickness or as specified shall be fixed to the frame with rivets or welds as approved by the Engineer-in-charge.

10.3.2 Fittings and Fixtures

10.3.3 The shutters shall be fixed to the wall masonry with four pin clamps (pintles).Each pin clamp shall consist of long bent and forked at one end and provided M.S. pin on the other. The pin shall be firmly riveted or welded to the pin clamp, the other end of which shall be embedded in masonry by means of cement concrete block. It shall be so placed that bottom pin shall face upwards and —top pin downward‖ in order that the gate may not be removed by lifting over pins.

10.3.4 One hook with eye shall be provided for each shutter to keep it fixed in open position. The hook shall be fixed in wall masonry with wooden block and the eye shall be fixed on M.S. plate as staple and fixed in the shutter frame with rivet or weld.

10.4 ROLLINGSHUTTERS

10.4.1 Rolling shutters shall conform to IS 6248. These shall include necessary locking arrangement and handles etc. These shall be suitable for fixing in the position as specified i.e. outside or inside on or below lintel or between jambs of the opening. The door shall be either push and pull type or operated with mechanical device supplied by the firm. Shutters upto 10 sq. metre shall be of push and pull type and shutters with an area of over 10 sq. metre shall generally be provided with reduction gear operated by mechanical device with chain or handle, if bearings are specified for each of operation, these shall be paid for separately.

10.4.2 The shutter be built up of inter locking lath section formed from cold rolled steel strips. The thickness of the sheets from which the lath sections have been rolled shall be not less than 0.90 mm for the shutters upto 3.5 m width. Shutters above 9 metres width should be divided in 2 parts with provision of one middle fixed or movable guide channel or supported from the back side to resist wind pressure. The lath section shall be rolled so as to have interlocking curls at both edges and a deep corrugation at the centre with a bridge depth of not less than 12 mm to provide sufficient curtain of stiffness for resisting manual pressures and normal wind pressure. Each lath section shall be continuous single piece without any welded joint. When interlocked, the lath sections shall have a distance of 75 mm rolling centers. Each alternate lath section shall be fitted with malleable cast iron or mild steel clips securely riveted at either ends, thus locking in the lath section

at both ends preventing lateral movement of the individual lath sections. The clips shall be so designed as to fit the contour of the lath sections

10.4.3 Spring:

The spring shall be of coiled type. The spring shall be manufactured from high tensile spring steel wire or strips of adequate strength conforming to IS 4454-PartI

10.4.4 Roller and Brackets:

The suspension shaft of the roller shall be made of steel pipe conforming to heavy duty as per IS 1161. For shutter upto 6 metre width and height not exceeding 5 metre, steel pipes of 50 mm nominal bore shall be used. The shaft shall be supported on mild steel brackets of size 375 x 375 x 3.15 mm for shutters upto a clear height of 3.5 metre. The size of mild steel brackets shall be 500 x 500 x 10 mm for shutters of clear height above 3.5 m and upto 6.5 m. The suspension shaft clamped to the brackets shall be fitted with rotatable cast iron pulleys to which the shutter is attached. The pulleys and pipe shaft shall connected by means of pretension helical springs to counter balance the weight of the shutter and to keep the shutter in equilibrium in any partly open position.

10.4.5 When the width of the opening is greater than 3.5 mtr. The cast iron pulleys shall be interconnected with a cage formed out of mild steel flats of at least 32 x 6 mm and mild steel dummy rings made of similar flats to distribute the torque uniformly. Self-aligning two row ball bearing with special cast iron casings shall be provided at the extreme pulley and caging rings shall have a minimum spacing of 15mm and at least 4 number flats running throughout length of roller shall be provided.

10.4.6 Guide Channel:

The width of guide channel shall be 25 mm the minimum depth of guide channels shall be as follows

Clear width of shutters	Depth of guide channel
Upto3.5m	65mm
3.5mupto8m	75mm
8mandabove	100mm

10.4.7 The gap between the two legs of the guide channels shall be sufficient to allow the free movement of the shutter and at the same time close enough to prevent rattling of the shutter due to wind..

10.4.8 Each guide channel shall be provided with a minimum of three fixing cleats or supports for attachment to the wall or column by means of bolts or screws. The spacing of cleats shall not exceed 0.75 m. alternatively, the guide channels may also be provided with suitable dowels, hooks or pins for embedding in the walls.

10.4.9 The guide channels shall be attached to the jambs, plumb and true either in the overlapping fashion or embedded in grooves, depending on the method of fixing.

10.4.10 Cover: Top cover shall be of mild steel sheets not less than 0.90 mm thick and stiffened with angle or flat stiffeners at top and bottom edges to retain shape

10.4.11 Lock plates with sliding bolts, handles and anchoring rods shall be as per IS 6248.

10.5 STEEL DOORS, WINDOWS, VENTILATORS AND COMPOSITE UNITS

10.5.1 Hot rolled steel sections for fabrication of steel doors, windows, ventilators and fixed lights shall conform to IS 7452. Shapes weights and designations of hot rolled sections shall be as per IS 7452.The fabricated steel doors, windows, ventilators and composite units shall confirm to IS 1038 with up-to-date amendments and shall be IS marked (IS 1038).

10.5.2 Finishing:

10.5.3 All steel surfaces shall be thoroughly cleaned of rust, scale and dirt. Where so specified. The steel surface shall be treated for rust proofing by the hot dip, zinc spray or electro galvanizing process. Priming coat of approved steel primer i.e. red oxide/ zinc chromate primer conforming to IS 2074 shall be given. The fabricated steel door, windows, ventilators and composite units shall be inspected in the factory and approved by the Engineer-in-charge before priming coat is applied.

10.5.4 Final finishing coat shall be given to the doors, windows and ventilators after they are erected and fixed in final position. The rate shall be exclusive of final finishing coats but shall include the priming coat.

10.6 PRESSED STEEL DOOR FRAMES

10.6.1 Materials

Steel door frames shall be manufactured from commercial mild steel sheet of specified thickness, conforming to IS 2062 and 4351.

10.6.2 Construction

Each door frame shall consist of hinge jamb, lock jamb, head and if required angle threshold. These shall be welded or rigidly fixed together by mechanical means. Where no angle threshold is required, temporary base tie shall be screwed to the feet of frames in order to form a rigid unit.

10.6.3 Fabrication

The pressed steel door frames shall be got fabricated in an approved workshop.

10.6.4 Fixing Lugs:

There shall be three adjustable lugs with split end tail to each jamb without fan light, and four for jamb with fan light.

10.6.5 Hinges:

The hinges shall be so fixed that the distance from the inside of the head rebate to the top of the upper hinge is 20 cm and the distance from the bottom of the door frame to the bottom of the bottom hinge is also kept about 200 mm. The middle hinges shall be at equal distances from lower and upper hinges or as agreed to between the purchaser and the supplier.

10.6.6 Mortar Guards:

Mortar guards of thickness of main frame sheet shall be provided in accordance to provisions of IS 4351 and as instructed by Engineer-in-charge shall be provided.

10.6.8 Lock –Strike Plate:

There shall be an adjustable lock- strike plate of steel complete with mortar guard to make provision for locks or latches complying with the relevant Indian Standards(IS 4351) Lock-strike plates shall be of galvanized mild steel and fixed at 95 cm from the head of the frame.

10.6.9 Shock Absorbers:

For side hung door there shall not be less than three buffers or rubber or other suitable material inserted in holes in the rebate. One shall be located at the centre of the lock jam band the other two shall be at 30 cm from top and bottom of the frame. For double leaf shutter door, two buffers shall be provided.

10.6.10 Finishing

The surface of door frame shall be thoroughly cleaned, free of rust, mill-scale dirt oil etc. Either by mechanical means, for example sand or shot blasting or by chemical means such as picking. After retreatment of the surface one coat of approved primer i.e. red oxide zinc chrome primer conforming to IS 2074. Two coats of paints as directed by the Engineer-in-charge shall be applied to the exposed surface.

10.5.11 Fixing

Frames shall be fixed up right in plumb and plane. To avoid sag or bow in width during fixing or during construction phase, temporary struts across the width preventing sides bulging inwards may be provided. Wall shall be built solid on each side and grouted at each course to ensure solid contact with frame leaving no voids behind the frame

11.1 Flooring: List of Bureau of Indian Standard Codes

S. No.	IS Codes	Subject
1	IS 269	Specification for 33 grade ordinary portland Cement
2	IS 401	Code of practice for preservation of timber
3	IS 455	Specification for portland slag cement
4	IS 702	Specification for industrial bitumen
5	IS 1124	Method of test for determination of water absorption,
6	IS 1130	Specification for marble (blocks, slabs and tiles)
7	IS 1141	Code of practice for Seasoning of timber
8	IS 1200-(Part	Method of measurement of Building and Civil Engineering
9	IS 1237	Edition 2.3 Specification for cement concrete flooring tiles
10	IS 1322	Specification for bitumen felts for water proofing and damp-proofing
11	IS 1443	IS 1443 Code of practice for laying and finishing of cement
12	IS 1489 (Part-I)	Specification for Portland pozzolana cement (Part-I) flyash
13	IS 1489-(Part	Specification for Portland pozzolana cement (Part II)
14	IS 1580	Specification for bituminous compounds for water proofing
15	IS 2571	Code of practice for laying in-situ cement concrete flooring
16	IS 3622	Specification for sand stone (Slab & Tiles)
17	IS 4457	Acid and/or alkali Resistant tiles.
18	IS 5766	Code of practice for laying of burnt clay brick floor
19	IS 8041	Specification for rapid hardening portland cement

20	IS 8042	Specification for white portland cement
21	IS 8043	Specification for hydrophobic portland cement
22	IS 8112	Specification for 43 grade ordinary portland cement
23	IS 12330	Specification for sulphate resisting portland cement.
24	IS: 13630	Methods of Testing of ceramic tiles
25	IS 13712	Specification for ceramic tiles; definition, classification
26	IS 15622	Specification for pressed ceramic tile

11.2 BRICK ON EDGE FLOORING

11.2.1 Bricks

Bricks of Specified class designations shall be used. These shall conform to the specifications described. Broken bricks shall not be used in flooring except for closing the line. The bricks shall be laid on edge.

11.2.2 Mortar

The mortar used shall be as specified (in case of dry bricks flooring fine sand shall be filled in the joints).

11.2.3 Base Concrete

11.2.3.1 Flooring shall be laid on base concrete where so provided. The base concrete shall be provided with the slope required for the flooring. Floors in veranda, courtyard kitchens, and baths shall have slope ranging from 1:36 to 1:48 depending upon locations as decided by the Engineer-in-Charge. Floors in water closet portion shall have slope of 1:30 or as decided by the Engineer-in-Charge to drain off washing water. Plinth masonry off-set shall be depressed so as to allow the base concrete to rest on it.

11.2.3.2 If the base is of lean cement concrete, the flooring shall commence within 48 hours of the laying of base, failing which, the surface of base shall be roughened with steel wire brushes without disturbing the concrete. Before laying the flooring the base shall be wetted and smeared with a coat of cement slurry at 2 kg of cement spread over an area of one sqm so as to get a good bond between sub-grade and flooring.

11.2.3.3 Where base concrete is not provided, the earth below shall be properly sloped, watered, rammed and consolidated. Before laying the flooring, it shall be moistened.

11.2.4 Soaking of Bricks

Bricks required for flooring shall be perfectly soaked in stacks before use, by profusely spraying clean water at regular intervals for a period of not less than six hours so as to keep them wet to the satisfaction of the Engineer-in-Charge. (In case the joints are to be filled with sand, the bricks need not be soaked).

11.2.5 Laying

11.2.5.1 The bricks shall be laid on the edge; diagonal herring bone bond, or other pattern as specified or directed by the Engineer-in-Charge.

11.2.5.2 Bricks shall be laid on edge on 12 mm thick mortar of specified ratio bed and each brick shall be properly bedded and set home by gentle tapping with trowel handle or wooden mallet. It's inside face shall be buttered with mortar, before the next brick is laid and pressed against it.

11.2.5.3 On completion of a portion of flooring, the vertical joints shall be fully filled from the top with mortar. During laying, the surface of the flooring shall be frequently checked with a straight edge of length at least 2 m, so as to obtain a true plain surface with the required slope.

11.2.6 Joints

Bricks shall be so laid that all joints are full of mortar. The thickness of joints shall not exceed 1.0 cm for brick work with bricks of any class designation. All face joints shall be raked to a minimum depth of15mm by raking tool during the progress of work when the mortar is still green so as to provide proper key for the plaster or pointing to be done. Where plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. The face of brick work shall be cleaned on the same day on which brick work is done and all mortar droppings removed promptly.

11.2.7 Curing

Brick work shall be protected from rain by suitable covering when the mortar is green. Brick work in cement mortar, shall be kept constantly moist on all faces for a minimum period of seven days. Brickwork carried out shall be suitably marked indicating the date on which the work is done so as to keep awatch on the curing period.

11.2.8 Dry Brick Flooring

All provisions of para's 11.1 to11.2.7 will be applicable except that bricks need not be soaked. Bricks will be laid on a bed of 12 mm thick mud mortar laid to required slope. The joints shall be as thin as possible and not exceeding 5 mm which will be filled with fine sand. No curing is to be done.

11.3 CEMENT CONCRETE FLOORING

11.3.1 Cement Concrete

Cement concrete of specified mix grade shall be used and it shall generally conform to the specifications described under sub head 4.0 CPWD Specification (vol.1) 2009

11.3.2 Base Concrete

11.3.2.1 Flooring shall be laid on base concrete where so provided. The base concrete shall be provided with the slopes required for the flooring. Flooring in verandah, Courtyard, kitchens & baths shall have slope ranging from 1 : 48 to 1 : 60 depending upon location and as decided by the Engineer-in-Charge. Floors in water closet portion shall have slope of 1:30 or as decided by the Engineer-in-Charge to drain off washing water. Further, necessary drop in flooring in bath, W C, kitchen near floor traps ranging from 6 mm to 10 mm will also be provided

to avoid spread of water. Necessary margin to accommodate this drop shall be made in base concrete. Plinth masonry off set shall be depressed so as to allow the base concrete to rest on it.

11.3.2.2 The flooring shall be commenced preferably within 48 hours of the laying of base concrete. The surface of the base shall be roughened with steel wire brushes without disturbing the concrete. Immediately before laying the flooring, the base shall be wetted and a coat of cement slurry @ 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

11.3.2.3 If the cement concrete flooring is to be laid directly on the RCC slab, the top surface of RCC slab shall be cleaned and the laitance shall be removed and a coat of cement slurry @ 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

11.3.3 Thickness

The thickness of floor shall be as specified in the description of the item.

11.3.4 Laying

11.3.4.1 Panels:

Flooring of specified thickness shall be laid in the pattern including the border as given in the drawings or as directed by the Engineer-in-Charge. The border panels shall not exceed 450 mm in width and the joints in the border shall be in line with panel joints. The panels shall be of uniform size and no dimension of a panel shall exceed 2 m and the area of a panel shall not be more than 2 sqm. The joints of borders at corners shall be mitred for provision of strips.

11.3.4.2 Laying of Flooring with Strips:

Normally cement concrete flooring shall be laid in one operation using glass/aluminium/PVC/brass strips/stainless steel strips or any other strips as required as per drawing or instructions of the Engineer-in-Charge, at the junction of two panels. This method ensures uniformity in colour of all the panels and straightness at the junction of the panels. 4 mm thick glass strips or 2 mm PVC strips or 2 mm aluminium or brass strips shall be fixed with their tops at proper level, giving required slopes. Use of glass and metallic strips shall be avoided in areas exposed to sun. Cost of providing and fixing strips shall be paid for separately.

Concreting: Cement concrete shall be placed in the panels and be levelled with the help of straight edge and trowel and beaten with thapy or mason‘s trowel. The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given. Beating shall cease as soon as the surface is found covered with a thin layer of cream of mortar. The evenness of the surface shall be tested with straight edge. Surface of flooring be true to required slopes. While laying concrete, care shall be taken to see that the strips are not damaged/disturbed by the labourers. The tops of strips shall be visible clearly after finishing with cement slurry.

Shuttering: The panels shall be bounded by angle iron or flats. The angle iron/flat shall have the same depth as the concrete flooring. These shall be fixed in position, with their top at proper level giving required slopes. The surface of the angle iron or flats, to come in contact with concrete shall be smeared with soap solution or non- sticking oil (Form oil or raw linseed oil) before concreting. The flooring shall butt against the un-plastered masonry wall.

Concreting: The concreting shall be done in the manner described under 11.3.4.2. The angle iron/ flats used for shuttering, shall be removed on the next day of the laying of cement concrete. The ends thus exposed shall be repaired, if damaged with cement mortar 1: 2 (1 cement: 2 coarse sand) and allowed to set for minimum period of 24 hours. The alternate panels shall then be cleaned of dust, mortar, droppings etc. and concrete laid. While laying concrete, care shall be taken to see that the edges of the previously laid panels are not damaged and fresh mortar is not splashed over them. The joints between the panels should come out as fine straight lines.

11.3.5 Finishing

11.3.5.1 The finishing of the surface shall follow immediately after the cessation of beating. The surface shall be left for some time, till moisture disappears from it or surplus water can be mopped up. Use of dry cement or cement and sand mixture stiffening the concrete to absorb excessive moisture shall not be permitted. Excessive trowelling shall be avoided.

11.3.5.2 Fresh cement shall be mixed with water to form a thick slurry and spreaded @ 2 kg of cement over an area of one sqm of flooring while the flooring concrete is still green. The cement slurry shall then be properly processed and finished smooth.

11.3.5.3 The edges of sunk floors shall be finished and rounded with cement mortar 1:2 (1 cement: 2 coarse sand) and finished with a floating coat of neat cement.

11.3.5.4 The junctions of floor with wall plaster, dado or skirting shall be rounded off where so specified.

11.3.6 Curing

The curing shall be done for a minimum period of ten days. Curing shall not be commenced until the top layer has hardened.

11.3.7 Precautions

Flooring in lavatories and bath room shall be laid only after fixing of water closet and squatting pans and floor traps. Traps shall be plugged while laying the floors and opened after the floors are cured and cleaned. Any damage done to W.C.'s squatting pans and floor traps during the execution of work shall be made good. During cold weather, concreting shall not be done when the temperature falls below 4°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. During

hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38° C.

11.4 CEMENT CONCRETE FLOORING WITH METALLIC HARDENER TOPPING

11.4.1 Wherever floors are required to withstand heavy wear and tear, use of floor hardener shall be avoided as far as possible by using richer mixes of concrete, unless the use of a metallic hardner is justified on the basis of cost. Where metallic hardener topping is used, it shall be 12 mm thick.

11.4.2 Metallic Hardening Compound

The compound shall be of approved quality consisting of uniformally graded iron particles, free from non-ferrous metal particles, oil, grease sand, soluble alkaline compounds. Where so directed by the Engineer-in-Charge it shall be tested as described in Appendix A of CPWD specifications Vol.1 chapter 11.

11.4.3 under Layer

Cement concrete flooring of specified thickness and mix (mentioned in item for under layer) shall be laid as under layer (11.3.1 and 11.3.4).

11.4.4 Topping

This shall consist of 12 mm thick layer of mix 1:2 (1 cement: 2 stone aggregate 6 mm nominal size)by volume or as otherwise specified with which metallic hardening compound is mixed in the ratio of 1 :4 (1 metallic concrete hardener : 4 cement) by weight. The mixture so obtained shall be laid in 12 mm thickness, on cement concrete floor within 2 to 4hours of its laying. The topping shall be laid true to provide a uniform and even surface.

11.5 CEMENT PLASTER IN RISERS OF STEPS, SKIRTING, DADO

11.5.1 Plaster at the bottom of wall not exceeding 30 cm in height above the floor shall be classified as skirting. It shall be flush with wall plaster or projecting out uniformly by 6 mm from the wall plaster, as specified.

11.5.2 Thickness

The thickness of the plaster specified shall be measured exclusive of the thickness of key i.e. grooves or open joints in brick work.

11.5.3 Preparation of Wall Surface

The joints shall be raked out to a depth of at least 15 mm in masonry walls. In case of concrete walls, the surfaces shall be roughened by hacking. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

11.5.4 Application

Skirting with specified mortar and to specified thickness shall be laid immediately after the surface is prepared.

11.5.6 Finishing

The finishing of surface shall be done simultaneously with the borders or the adjacent panels of floor. The cement to be applied in the form of slurry for smooth finishing shall be at the rate of 2 kg of cement per litre of water applied

over an area of 1 sqm. Where skirting is flush with plaster, a groove 10 mm wide and up to 5 mm deep shall be provided in plaster at the junction of skirting with plaster.

11.5.7 Curing

Curing shall be commenced on the next day of plastering when the plaster has hardened sufficiently and shall be continued for a minimum period of 7 days.

11.6 CEMENT CONCRETE PAVEMENT IN COURTYARD AND TERRACE ETC.

11.6.1 Specifications described above shall hold good as far as applicable except that

(i) The panels shall be of uniform size and no dimension of a panel shall exceed 1.25 m and the area of panel should not exceed 1.25 sqm for the thickness of panels upto 50 mm.

(ii) Concreting shall be done in alternate panels only and no glass/asbestos strips shall be provided.

11.6.2 Finishing

The finishing of the surface shall follow immediately after the cessation of beating. The surface shall be left for some-time, till moisture disappears from it or surplus water can be mopped up. Use of dry cement or cement and sand mix on the surface to stiffen the concrete or to absorb excessive moisture shall not be permitted. Excessive trowelling shall be avoided. When the surface becomes fairly stiff, it shall be finished rough with wooden floats or where so specified chequered uniformly by pressing a piece of expanded metal of approved size.

11.7 TERRAZO (MARBLE CHIPS) FLOORING LAID IN SITU

11.7.1 Under Layer

Cement concrete of specified mix shall be used and the specifications given under sub head 4.0 shall apply. The panels shall be of uniform size, not exceeding 2 sqm in area or 2 m in length for inside situations.

In exposed situations, the length of any side of the panel shall not be more than 1.25 metre. Cement slurry@ 2.00 kg per sqm shall be applied before laying of under layer over the base cement concrete/RCC base.

11.7.2 Fixing of Strips

4 mm thick glass strips or 2 mm thick PVC strips/aluminium strips/brass strips / stainless steel strips/copper strips unless otherwise specified shall be fixed with their top at proper level to required slope. Strips of stone or marble or of any other material of specified thickness can also be used if specifically required. Use of glass and metallic strips shall be avoided in areas exposed to sun. The fixing and laying shall be as specified in para 11.3.4.2.

11.7.3 Top Layer

11.7.3.1 Mortar: The mix for terrazo shall consist of cement with or without pigment, marble powder, marble aggregate (marble chips) and water. The cement and

marble powder shall be mixed in the proportion of three parts of cement to one part marble powder by weight. The marble chips shall be white or pink Makrana, black Bhainslana, Chittoor black, Jaisalmer Yellow, Baroda green, Dehradun white, Chittoor pink, yellow Patamcherala (Madras), grey Gadu (Surat),Chittoor green and yellow and Alwar black or as specified. It shall be hard, sound, dense and homogenous in texture with crystaline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering. The maximum thickness of the top layer for various sizes of marble aggregates (marble chips) shall be as shown in Table 11.1

Grade No.	Size of Aggregates in (mm)	Proportion of Aggregates to Binder Mix	MinimumThickness of Top Layer (mm)
00	1-2	1.75 : 1	6
0	2-4	1.75 : 1	6
1	4-7	1.75 : 1	9
2	7-10	1.5:1	12

Where aggregate of size larger than 10 mm are used, the minimum thickness of topping shall not be less than one and one third times the maximum size of the chips. Where large size chips such as 20 mm or 25 mm are used, they shall be used only with a flat shape and bedded on the flat face so as to keep the minimum thickness of wearing layer. The cement to be used shall be ordinary grey cement, white cement, cement with admixture of colouring matter of approved quality in the ratio specified in the description of the item in the ratio to get the required shade as ordered by the Engineer-in-Charge. The terrazo topping shall be laid while the under layer is still plastic, but has hardened sufficiently to prevent cement from rising to the surface. This is normally achieved between 18 to 24 hours after the under layer has been laid.

11.7.3.2 Curing, Polishing and Finishing: The surface shall be left dry for air-curing for a duration of 12 to 18 hours depending on atmospheric temperature conditions. It shall then be cured by allowing water to stand in pools over it for a period of not less than 4 days. The grinding and polishing may be commenced not before 2 days from the time of completion of laying for manual grinding and not before 7 days for maching grinding. For polishing by machines, the surface shall be watered and ground evenly with machine fitted with special rapid cutting grit blocks(carborundum stone) of coarse grade (No. 60) till the marble chips are evenly exposed and the floor is smooth. After the first grinding, the surface shall be thoroughly washed to remove all grinding mud and covered with a grout of cement and colouring matter in same mix and proportion as the topping in order to fill any pin holes that appear. The surface shall be allowed to dry for 24 hours and wet cured for 4 days and then rubbed with machine fitted with fine grit blocks (No. 120). Curing shall be done by ponding of water between panels formed with fine sand. The surface is cleaned and repaired as before and allowed to cure again for 3 to 5 days. Finally the third grinding shall be done with machine

fitted with mere fine grade grit blocks (No. 320) to get even and smooth surface without pin holes. The finished surface should show the marble chips evenly exposed. After the final polish either by machine or by hand, oxalic acid shall be dusted over the surface @ 33 gm per square metre sprinkled with water and rubbed hard with a nemdah block (Pad of Woolen rags). The following day, the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean. Curing shall be done by suitable means such as laying moist sawdust or ponding water.

11.7.4 Precautions

Flooring in lavatories and bathrooms shall be laid after fixing of water closet and squatting pans and floor traps. Traps shall be plugged, while laying the floors and opened after the floors are cured and cleaned. Any damage done to WC's squatting pans and floor traps during the execution of work shall be made good.

11.8 TERRAZO (MARBLE CHIPS) SKIRTING IN SITU

11.8.1 Under Coat

The under coat of skirting shall be of cement plaster of the thickness and mix described in the item. Specifications given under 11.5,11.5.2 and 11.5.3 shall apply. As regards application, the work shall be carried out in the manner described in para CPWD Specification (vol.1) 2009 chapter 11except that the under coat shall be finished rough with a scratching tool to form a key for the top coat.

11.8.2 Top Coat

The specifications as in para 11.7.3 shall hold good as far as applicable and shall include cutting to line and fair finish to top edges of terrazo and polishing.

11.8.3 Thickness

The total thickness of skirting specified is of the total thickness of plaster including top coat as measured from the unplastered face of the masonry. Average thickness of the under coat shall not be less than 6mm and minimum thickness over any portion of the surface shall not be less than 4 mm. The thickness of top coat shall not be less than the thickness specified.

11.9 WAX POLISHING

11.9.1 Application, Polishing and Precautions Wax polish shall be of approved brand and manufacture and in sealed containers. It shall be applied in uniform layer to the dry surface of the floor/skirting.

11.9.2 When the layer of the wax is stiffened and surface of floor is saturated with the polish, polishing shall be resorted with machine fitted with bobs (pad of rags) and shall be done until shades of all chips have appeared and glossy surface is obtained.

11.9.3 The fresh polished floor surface shall be spreaded with dry saw dust to a thickness of about 12 mm uniformly. After the surplus wax has been soaked from the floor surface the saw dust shall be removed.

11.10 CRAZY MARBLE FLOORING

11.10.1 Base Concrete

Crazy marble stone flooring shall be laid on cement concrete base. The base concrete shall be provided with slope required for the flooring in verandahs and courtyards to drain off washing and rainwater. The surface of base shall be roughened with steel wire brushes, without disturbing the concrete, wetted and smeared with a floating cost of cement slurry at 2 kg of cement spread over an area of one sqm so as to get a good bond between base and flooring. Before laying the flooring on RCC slabs, the laitance shall be removed, the surface of slab hacked and a coat of cement slurry at rate of 2 kg of cement spread over an area of one sqm shall be applied so as to get a good bond between RCC slab and floor.

11.10.2 Under Layer

The under layer of crazy marble flooring shall be of cement concrete of thickness 25 mm or as specified. The mix shall normally be 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5mm nominal size) by volume unless otherwise specified. It shall conform to the specifications given under para 4.2 of sub-head 'Cement Concrete'.

11.10.3 Top Layer

The mix of crazy marble stone flooring shall consist of white cement with or without pigment, marble powder, marble chips of 00 Nos. and marble stone pieces and water. The marble stone pieces shall be hard, sound, dense and homogenous in texture with crystaline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering. The white cement and marble powder shall be mixed in proportion of three parts of cement and one part of marble powder by weight, and the proportion of marble chips to binder mix by volume shall be 7 parts of marble chips to 4 parts of binder mix. The marble chips shall be as specified. It shall be hard, sound, dense and homogeneous in texture

11.10.4 Laying

A coat of cement slurry at the rate of 2 kg of cement per sqm of area shall be spread and then the marble stone pieces shall be set by hand in such a manner that the top surface of all the set marble stones shall be true to the required level and slopes. After fixing the stones, the cement marble chips mixture shall be filled in between the gaps of laid marble stone pieces. The filled surface then shall be trowelled over, pressed and brought to the level of the laid marble stone pieces.

11.10.5 Polishing

Curing and Finishing shall be as described in 11.7.3.2

11.11 TERRAZO TILE FLOORING

11.11.1 Terrazo Tiles

Terrazo tiles shall generally conform to IS 1237-Edition 2.3. Requirements and methods of testing of tiles are described in Appendix B. Unless otherwise specified, the tiles shall be supplied with initial grinding and grouting of wearing layer. The size of tiles shall be as given in Table as shown below in the drawings or as required by the Engineer-in-Charge. Half tiles for use with the full tiles shall be such as to make two half tiles when joined together, match with the dimensions of one full tile.

Length Nominal	Breadth Nominal	Thickness not less than
200 mm	200 mm	20 mm
250 mm	250 mm	22 mm
300 mm	300 mm	300 mm

11.1 Tolerance: Tolerances on length and breadth shall be plus or minus one millimetre, and tolerance on thickness shall be plus 5 mm. The variation of dimensions in any one delivery of tiles shall not exceed 1 mm on length and breadth and 3 mm on thickness.

11.11.1.2 The tiles shall be manufactured in a factory under pressure process subjected to hydraulic pressure of not less than 140 kg per square centimetre and shall be given the initial grinding with machine and grouting of the wearing layer before delivery to site. The wearing layer shall be free from projections, depressions, cracks, holes, cavities and other blemishes. The edges of wearing layer maybe rounded.

11.11.1.3 The proportion of cement to aggregate in the backing of tiles shall be not leaner than 1:3 by weight. Where colouring material is used in the wearing layer, it shall not exceed 10 per cent by weight of cement used in the mix.

11.11.1.4 The finished thickness of the upper layer shall not be less than 5 mm for size of marble chips ranging from the smallest upto 6 mm and also, not less than 5 mm for size of marble chips ranging from the smallest upto 12 mm, and not less than 6 mm for size of marble chips varying from the smallest upto20 mm.

11.11.2 Laying

11.11.2.1 Base concrete or RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tiles shall be with cement mortar of specified proportion and in conformity with provisions in relevant para of chapter 'Mortar' in CPWD specifications Vol-1. Cement mortar 1:4 (1Cement: 4coarse sand) bedding shall be used. Average thickness of the bedding mortar shall be 20 mm and the thickness at any place shall not be less than 10 mm.

11.11.2.2 Cement mortar bedding shall be spread, tamped and corrected to proper levels and allowed to harden for a day before the tiles are set. If cement mortar is laid in bedding the terrazo tiles, these shall be set immediately after laying the mortar.

Over this bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 4.4 kg of cement per square metre over such an area as would accommodate about twenty tiles. Tiles shall be washed clean and shall be fixed in this grout one after another, each tile being gently tapped with a wooden mallet till it is properly bedded, and in level with the adjoining tiles. The joints shall be kept as thin as possible not exceeding 1 mm and in straight lines or to suit the required pattern. The joints shall be properly cleaned before filling with cement grout of matching colour.

11.11.2.3 The surface of the flooring during laying shall be frequently checked with a straight edge of length at least 2 metre, so as to obtain a true surface with the required slope.

11.11.2.4 Where full tiles or half tiles can not be fixed, tiles shall be cut (sawn) from full tiles to the required size and their edges rubbed smooth to ensure a straight and true joint.

11.11.2.5 Tiles which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster, skirting or dado. The junction between wall plaster and tile work shall be finished neatly and without waviness.

11.11.2.6 After the tiles have been laid, surplus cement grout that may have come out of the joints shall be cleared off.

11.11.3 Curing, Polishing and Finishing

11.11.3.1 The day after the tiles are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shape of the topping of the wearing layer of the tiles. The same cement slurry shall be applied to the entire surface of the tiles in a thin coat with a view to protect the surface from abrasive damage and fill the pin holes that may exist on the surface.

11.11.3.2 The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be grounded evenly with machine fitted with coarse grade grit block (No. 60). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, mixed with or without pigment to match the colour of the topping of the wearing surface in order to fill any pin hole that appear. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit block (No. 120).

11.11.3.3 The final grinding with machine fitted with the finest grade grit blocks (No. 320) shall be carried out the day after the second grinding described in the preceding para or before handing over the floor,as ordered by the Engineer-in-Charge.

11.11.3.4 For small areas or where circumstances so require, hand grinding/polishing with hand grinder may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundu stones, shall be used:

1st grinding — coarse grade stone (No. 60)

Second grinding — medium grade (No. 80)

Final grinding — fine grade (No. 120)

In all other respects, the process shall be similar as for machine polishing.

11.11.3.5 After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square metre sprinkled with water and rubbed hard with a 'namdah' block (pad of woollen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

11.11.3.6 If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

11.12 TERRAZO TILES IN RISERS OF STEPS, SKIRTING AND DADO

11.12.1 The terrazo tiles shall be as specified in 11.11.1, as far as applicable. The minimum finished thickness of tiles shall, however, be 12 mm. The finished thickness of the upper layer shall be not less than 5 mm for size of marble chips from the smallest upto 12 mm and not less than 6 mm for size of chips varying from the smallest upto 20 mm. Where the bigger sized chips are used the tiles shall be not less than 20 mm thick.

11.12.2 Preparation of Surface

The specification for this shall be same as specified in 11.5.3

11.12.3 Laying

12mm thick plaster of cement mortar 1:3 (1 cement: 3 coarse sand) or mix as specified, shall then be applied and allowed to harden. The plaster shall then be roughened with wire brushes or by scratching diagonal lines 2 mm deep at approximately 7.5 cm centres both ways. The back of tiles shall be buttered with a coat of grey cement slurry and edges with grey or white cement slurry with or without pigments to match the shade of tiles, and set in the bedding mortar. These shall be tamped and corrected to proper planes and lines. The tiles shall be set in the required pattern and butt jointed. The joints shall be as fine as possible. Top of skirting or dado shall be truly horizontal with projection from finish wall surface not more than tile thickness and joints truly vertical except where otherwise indicated. The risers of steps, skirting or dado shall rest on the top of the tread or flooring. Where full size tiles cannot be fixed, the tiles shall be cut (sawn) to the required size and their edges rubbed smooth.

11.12.4 Curing, Polishing and Finishing

The specifications as in 11.11.3 shall hold good as far as applicable. Polishing shall be done only with hand.

11.13 CHEQUERED TILE FLOORING

11.13.1 Chequered Tiles

The tiles shall be of nominal sizes such as 20 × 20 cm, 25 × 25 cm and 30 × 30 cm or of standardizes with equal sides. The size of tiles to be used shall be as shown in drawings or as required by the Engineer-in-Charge. The centre to centre distance of chequers shall not be less than 2.5 cm and not more than 5 cm. The overall thickness of the tiles shall not be less than 30 mm. The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered tiles shall be cement tiles, or terrazo tiles as specified in the description of the item. The thickness of the upper layer, measured from the top of the chequers shall not be less than 6 mm The terrazo tiles shall be given the first grinding with machine before delivery to site. The tiles shall conform to the specifications for plain cement concrete or terrazo tiles in respect of method of manufacture and the mix of the backing and wearing layers.

11.13.2 Laying, curing, Polishing and Finishing shall be as specified in 11.11.2 and 11.11.3 except that the polishing of the tiles and the chequer grooves, after laying, may be done by hand.

11.14 CHEQUERED TILES IN STAIR TREADS

11.14.1 Chequered Tiles

The specifications for tiles shall be as specified in 11.13.1 except in the following respects :

(1) The length of the tiles including nosing shall be as specified.

(2) The nosing edge of the tile shall be rounded.

(3) The minimum thickness of the tile shall be 30 mm.

(4) The front portion of the tile for a minimum length of 75 mm from and including the nosing shall have grooves running parallel to the nosing and at centres not exceeding 25 mm. Beyond that the tiles shall have the normal chequer pattern.

(5) The nosing shall also have the same wearing layer as the top.

11.14.2 Preparation of Surface and Laying

11.14.2.1 RCC or brick work in treads on which the tiles are to be laid shall be cleaned wetted and mopped. The bedding for tiles shall be with cement mortar 1:4 (1 cement: 4 coarse sand) or of specified mix. The minimum thickness of bedding mortar at any place shall be 10 mm. Bedding mortar shall be spread, tamped and corrected to proper levels. After laying bedding mortar, neat grey cement slurry of honey like consistency shall be spread over the mortar at the rate of 4.4 kg of cement per square metre over each tread. Tiles shall be washed cleaned and shall be fixed in this grout butting one at another. Each tile being gently tapped with a wooden mallet till it is properly bedded, and is in level and line with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines. The surface shall be checked with a straight edge during laying to obtain a true surface.

11.14.2.2 The square end of the tile shall, as far as possible butt against the riser face of the concrete or brick tread and in any case shall be embedded under the side wall plaster, skirting or dado and under the riser tile or other finish to a depth of not less than 10 mm.

11.14.2.3 Where full size tiles cannot be fixed, these shall be cut (sawn) to the required size (along the groove of the chequers where the cut edge is exposed) and used. The cut in the case of embedded edges will be neat and true while the cut in the case of exposed edges shall in addition be rubbed smooth to ensure a straight and true joints.

11.14.2.4 After the tiles have been laid surplus cement grout shall be cleaned off.

11.14.3 Curing, Polishing and Finishing

The specifications shall be as described in 11.11.3 except that polishing of the treads nosing and chequered grooves, after laying, may be done by hand in the same manner as specified under terrazzo tile flooring. Special care shall be taken to polish the nosing and the grooves in such a manner as to get a uniform, section for the grooves and the nosing and their finish shall match with the finish of the flat portion of the tiles.

11.15 ACID OR ALKALI RESISTANT TILES

11.15.1 Manufacture and Finish

The tiles shall be of vitreous ware and free from deleterious substances. The iron oxide content allowable in the raw material shall not exceed two percent. The tiles shall be vitrified at the temperature of 11000C and above and shall be kept unglazed. The finished, tile, when fractured shall appear fine-grained in texture, dense and homogenous. The tiles shall be sound, true to shope, flat and free from flows and manufacturing defects affecting their utility. The tiles shall be conforming to IS 4457. The tiles to be tested for water absorption, compressive strength, acid resistance as per IS 4457. Sampling procedure for acceptance tests and criteria for conformity to be as per IS 4457. The tiles shall be of required colour

11.15.2 Dimensions and Tolerances

Ceramic unglazed vitreous acid-resistant tiles shall be made in three sizes namely 98.5 X 98.5 mm, 148.5 X 148.5 mm and 198.5 X 198.5 mm. They shall be available in the following thickness: 35, 30, 25, 20 and 15 mm. The depth of the grooves on the underside of the tile shall not exceed 3 mm. Tolerance on length, breadth and thickness of tiles shall be +2 percent

11.15.3 Shape

The tiles shall be square shaped. Half tiles rectangular in shape shall also be available. Half tiles for use with full tiles shall have dimensions which shall be such

as to make two half tiles, when joined together, match with the dimension of full tile. The shape of tiles other than square shall be as agreed to between the purchaser and the manufacturer. Tiles shall be checked for squareness and warp as per IS4457.

11.15.4 Performance Requirements

The tiles when tested in accordance with method given in IS 4457, shall conform to be requirement specified in the code (IS 4457).

11.15.5 Loss in Abrasion

The maximum percentage of loss in abrasion of the ceramic unglazed vitreous acid resistant tiles determined in accordance with the procedure laid down in IS 1237, shall be as mentioned in IS 4457.

11.15.6 Marking

Tiles shall be legibly marked on the back with the name of the manufacturer or his trade mark. Manufacturer‘s batch number and year of manufacture. Each tile may also be marked with the ISI certification mark.

11.15.7 Preparation of Surface and Laying

Preparation of surface and laying to be according to para 11.16.4, except the cement used to be acid and or alkali resistant cement and cement mortar to be used to be acid and or Alkali resistant mortar. Thickness of bedding of mortar for flooring to be 10 mm or specified on the item and for dado/skirting to be 12 mm or specified on item.

11.15.8 Pointing and Finishing

As per 11.15.5 except that cement used for pointing to be acid and or alkali resistant cement.

11.16 PRESSED CERAMIC TILE FLOORING

11.16.1 Pressed Ceramic Tiles

The tiles shall be of approved make and shall generally conform to IS 15622. They shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as per IS 13630Classification and Characteristics of pressed ceramic tiles shall be as per IS 13712. The tiles shall be square or rectangular of nominal size. Table 1,3,5, and 7 of IS 15622 give the modular preferred sizes and table 2,4,6 and 8 give the most common non modular sizes. Thickness shall be specified by the manufacturer. It includes the profiles on the visible face and on the rear side. Manufacturer/supplier and party shall choose the work size of tiles in order to allow a nominal joint width upto 2mm for un rectified floor tiles and upto 1mm for rectified floor tiles. The joint in case of spacer lugtile shall be as per spacer. The tiles shall conform to table10 of IS 15622 with water absorption 3 to 6%(Group BII). The top surface of the tiles shall be glazed. Glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The

edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable, shall be permissible on only upto 50 per cent of the surface area of the edges.

11.16.2 Coloured Tiles

Only the glaze shall be coloured as specified. The sizes and specifications shall be the same as for the white glazed tiles.

11.16.3 Decorative Tiles

The type and size of the decorative tiles shall be as follows:

(i) Decorated white back ground tiles

The size of these tiles shall be as per IS 15622.

(ii) Decorated and having coloured back-ground

The sizes of the tiles shall be as per IS 15622.

11.16.4 Preparation of Surface and Laying

11.16.4.1 Base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as specified. The average thickness of the bedding shall be 20 mm or as specified while the thickness under any portion of the tiles shall not be less than 10 mm.

11.16.4.2 Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set and to enable the mason to place wooden plank across and squat on it.

11.16.4.3 Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 3.3 kg of cement per square metre over an area upto one square metre. Tiles shall be soaked in water washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

11.16.4.4 The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope. In bath, toilet W.C. kitchen and balcony/verandah flooring, suitable tile drop or as shown in drawing will be given in addition to required slope to avoid spread of water. Further tile drop will also be provided near floor trap.

11.16.4.5 Where full size tiles cannot be fixed these shall be cut (sawn) to the required size, and their edge rubbed smooth to ensure straight and true joints. Tiles which are fixed in the floor adjoining the wall shall enter not less than 10 mm under the plaster, skirting or dado.

11.16.5 Pointing and Finishing

The joints shall be cleaned off the grey cement slurry with wire/coir brush or trowel to a depth of 2mm to 3 mm and all dust and loose mortar removed. Joints

shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. Where spacer lug tiles are provided, the half the depth of joint shall be filled with polysulphide or as specified on top with under filling with cement grout without the lugs remaining exposed. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped with a wooden mallet.

11.17 PRESSED CERAMIC TILE FLOORING (VITRIFIED TILE FLOORING)

11.17.1 Operations as described in 11.15.1 to 11.15.6 shall be followed except the tiles shall conform to Table 12 of IS 15622 and the joint thickness inflooring shall not be more than 1mm.

11.18 FIXING OF TILE FLOORING WITH CEMENT BASED HIGH POLYMER MODIFIED QUICK SET ADHESIVE (WATER BASED)

11.18.1 When tile flooring is to be laid over the existing flooring without dismantling old flooring it can be laid with adhesive. The old flooring shall be thoroughly cleaned and checked for undulations, if any shall be rectified with cement mortar 1:3 (1cement: 3coarse sand). Old cement concrete surface shall be hacked and cleaned off to have proper bond with the old surface.

11.18.2 High polymer modified quick set tile adhesive (conforming to IS 15477) shall be thoroughly mixed with water and a paste of zero slump shall be prepared so that it can be used within 1.5 to 2hours. It shall be spread over an area not more than one sqm at one time. Average thickness of adhesive shall be 3 mm.

11.18.3 Where spacer lugs tiles are provided these shall be filled with grout with lugs remaining exposed.

11.18.4 Where full size tile cannot be fixed these shall be cut (sawn) to the required size and edges rubbed smooth to ensure straight and true joints. Tiles which are fixed in floor adjoining to wall shall enter not less than 10 mm under plaster, skirting or dado.

11.19 PRESSED CERAMIC TILES IN SKIRTING AND DADO

11.19.1 The tiles shall be of approved make and shall generally conform to IS 15622. The tiles shall be pressed ceramic covered by a glaze thoroughly matured and fitted to the body. The top surface of the tiles shall be glazed. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be free from glaze, however, any glaze if unavoidable shall be permissible on only upto 50 per cent of the surface area of edges.

11.19.1 (a) Dimensions and Tolerances

Glazed pressed cramic tiles shall be made square or rectangular in sizes Table 1, 3, 5 & 7 of IS15622 give the modular sizes and table 2, 4, 6 & 8 of IS 15622 gives the sizes of non-modular tiles. The tiles shall conform to IS 15622 for dimensional tolerance, physical and chemical properties. The thickness of the tiles shall be 5 mm or 6 mm or as specified. The dimensions of fittings associated with the

glazed tiles namely cover base, round edge tile, angles corner cups, ridge and legs, cornices and capping beads shall be of the shape and dimensions as required and the thickness of fittings shall be the same as the thickness of tiles given above.

11.19.2 Preparation of Surfaces

The joints shall be raked out to a depth of at least 15 mm in masonry walls. In case of concrete walls, the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

11.19.3 Laying

12 mm thick plaster of cement mortar 1:3 (1cement: 3 coarse sand) mix of as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonal at closed intervals. The tile should be soaked in water, washed clean, and a coat of cement slurry applied liberally at the back of tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines. The tiles shall be set in the required pattern and jointed. The joints shall be as fine as possible. Top of skirting or dado shall be truly horizontal and joints truly vertical except where otherwise indicated. Odd size/cut size of tile shall be adjusted at bottom to take care of slope of the flooring. Skirting and dado shall rest on the top of the flooring. Where full size tiles cannot be fixed these shall be cut (sawn) to the required size and their edges rubbed smooth. Skirting /dado shall notproject from the finished —surface of wall‖ by more than the tile thickness, undulations if any shall be adjusted in wall.

11.19.4 Curing and Finishing

The joints shall be cleaned off the grey cement grout with wire/coir brush or trowel to a depth of 2mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigments if required to match the colour of tiles. The work shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean. The finished work shall not sound hollow when tapped with a wooden mallet.

11.20 MARBLE STONE FLOORING

11.20.1 Marble Stone

It shall be as specified in sub head 8.0.CPWD specifications Vol-1 2009.

11.20.2 Dressing of Slabs

The top surface shall also be fine chisel dressed to remove all waviness. In case machine cut slabs are used, fine chisel dressing of machine cut surface need not be done provided a straight edge laid anywhere along the machine cut surfaces is in contact with every point on it. The sides and top surface of slabs shall be machine rubbed or table rubbed with coarse sand before paving. The thickness of the slabs shall be 18, 30 or 40 mm as specified in the description of the item.

Tolerance of + 3% shall be allowed for the thickness. In respect of length and breadth of slabs a tolerance of + 2% shall be allowed.

11.20.3 Laying

11.20.3.1 Base concrete or the RCC slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:4 (1 cement: 4 coarse sand) or as given in the description of the item.

11.20.3.2 The slabs shall be laid in the following manner: Mortar of the specified mix shall be spread under the area of each slab, roughly to the average thickness specified in the item. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped with wooden mallet and brought to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows. The mortar is allowed to harden a bit and cement slurry of honey like consistency shall be spread over the same at the rate of 4.4 kg of cement per sqm. The edges of the slab already paved shall be buttered with grey or white cement with or without admixture of pigment to match the shade of the marble slabs as given in the description of the item. The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible. Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The flooring shall be cured for a minimum period of seven days. The surface of the flooring as laid shall be true to levels, and, slopes as instructed by the Engineer-in-Charge. Joint thickness shall not be more than 1 mm. Due care shall be taken to match the grains of slabs which shall be selected judiciously having uniform pattern of Veins/streaks or as directed by the Engineer-in-Charge.

11.20.3.3 Slabs which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.

11.20.4 Polishing and Finishing

Slight unevenness at the meeting edges of slabs shall then be removed by fine chiselling and finished in the same manner as specified in 11.10.3 except that cement slurry with or without pigments shall not be applied on the surface before each polishing.

11.21 MARBLE STONE IN RISERS OF STEPS AND SKIRTING

11.21.1 Marble Stone Slabs and Dressing of Slabs shall be as specified in 11.20.1 and 11.20.2 except that the thickness of slabs shall be 18 mm. A tolerance of +3% mm shall be allowed, unless otherwise specified in the description of the item.

11.21.2 Preparation of Surface

It shall be as specified in 11.19.2 where necessary, the wall surface shall be cut uniformly to the requisite depth so that the skirting face shall have the projection

from the finished face of wall as required by the Engineer-in-Charge. In no case the skirting should project by more than thickness of stone.

11.21.3 Laying

The risers of steps and skirting shall be in grey or white cement admixed with or without pigment to match the shade of the stone, as specified in the description of the item, with the line of the slab at such a distance from the wall that the average width of the gap shall be 12 mm and at no place the width shall be less than 10 mm, if necessary, the slabs shall be held in position by temporary M.S. hooks fixed into the wall at suitable intervals. The skirting or riser face shall be checked for plane and plumb and corrected. The joints shall thus be left to harden then the rear of the skirting or riser slab shall be packed with cement mortar 1:3 (1 cement: 3 coarse sand) or other mix as specified in the description of the item. The fixing hooks shall be removed after the mortar filling the gap has acquired sufficient strength. The joints shall be as fine as possible but not more than 1 mm. The top line of skirting and risers shall be truly horizontal and joints truly vertical, except where otherwise indicated.

11.21.4 Curing, Polishing and Finishing

It shall be as specified in 11.12.4 as far as applicable, except that cement slurry with or without pigment shall not be applied on the surface and polishing shall be done only with hand. The face and top of skirting shall be polished.

11.22 KOTA STONE FLOORING

11.22.1 Kota Stone Slabs

The slabs shall be of selected quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as instructed by the Engineer-in-Charge. The slabs shall have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work the contractor shall get the samples of slabs approved by the Engineer-in-Charge.

11.22.2 Dressing

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides(edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane. The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the description of the item. Tolerance of ±2 mm shall be allowed for the thickness. In respect of length and breadth of slabs Tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

11.22.3 Preparation of Surface and Laying

The specification shall be as described in 11.20.3 except that the edges of the slabs to be jointed shall be buttered with grey cement, with admixture of pigment to match the shade of the slab. The thickness of the joints should be minimum as possible. In any location, it shall not exceed 1 mm.

11.22.4 Polishing and Finishing

The specifications shall be as described in 11.20.3 except that (a) first polishing with coarse grade carborundum stone shall not be done, (b) cement slurry with or without pigment shall not be applied on the surface before polishing.

11.23 KOTA STONE IN RISERS OF STEPS, SKIRTING AND DADO

11.23.1 Kota Stone Slabs and Dressing shall be as specified in 11.22.1 and 11.22.2 except that the thickness of the slabs shall be 25 mm or as specified in the description of the item. The slabs may be of uniform size if required.

11.23.2 Preparation of surface shall be as specified in 11.21.2

11.23.3 Laying shall be as specified in 11.21.3 except that the joints of the slabs shall be set in grey cement mixed with pigment to match the shade of the slabs.

11.23.4 Curing, Polishing and Finishing shall be as specified in 11.21.4 except that first polishing with coarse grade carborundum stone shall not be done.

11.24 RED OR WHITE FINE DRESSED SAND STONE FLOORING

11.24.1 Stone Slabs

The slabs shall be red or white as specified in the description of the item. The stone slabs shall be hard, sound, durable and tough, free from cracks, decay and weathering. In case of red sand stone, white patches or streaks shall not be allowed. However, scattered spots up to 10 mm diameter will be permitted. Before starting the work the contractor shall get samples of slabs approved by the Engineering-in charge. The slabs shall be hand or machine cut to the requisite thickness along planes parallel to the natural bed of stone and should be of uniform size if required.

11.24.2 Dressing of Slabs

Every slab shall be cut to the required size and shape and chisel dressed on all sides to a minimum depth of 20 mm. The top and the joints shall be fine tooled so that straight edge laid along the face is fully in contact with it. In case machine cut stones are used, chisel dressing and fine tooling of machine cut surface need not be done provided a straight edge laid anywhere along the machine cut surface is in contact with every point on it. The thickness of the slabs after dressing shall be 40 mm or as specified in the description of item with a permissible tolerance of ± 2 mm.

11.24.3 Laying

11.24.3.1 Base concrete on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:5 (1 cement: 5 coarse sand) or as given in the description of the item.

11.24.3.2 The average thickness of the bedding mortar under the slabs shall be 20 mm and the thickness at any place under the slabs shall not be less than 12 mm.

11.24.3.3 The slab shall be laid in the following manner: Mortar of specified mix shall be spreaded under each slab. The slab shall be washed clean before laying. It shall then be laid on top, pressed and larried, so that all hollows underneath get filled and surplus mortar works up through the joints. The top shall be tapped with a wooden mallet and brought to level and close to the adjoining slabs; with thickness of joint not exceeding 5 mm. Subsequent slabs shall be laid in the same manner. After lying each slab surplus mortar on the surface of slabs shall be cleaned off and joints finished flush.

11.24.3.4 In case pointing with other mortar mix is specified, the joint shall be left raked out uniformly and to a depth of not less than 12 mm when the mortar is still green. The pointing shall be cured for a minimum period of 7 days. The surface of the flooring as laid shall be true to levels and slopes as instructed by the Engineer-in-Charge.

11.24.3.5 Slabs which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster, skirting or dado. The junction between wall plaster skirting and floor shall be finished neatly and without waviness.

11.24.4.6 The finished floor shall not sound hollow when tapped with wooden mallet.

11.24.4 Finishing

In case of chisel dressed stone flooring slight unevenness, if any existing between the edges of slab sat joints shall then be removed by chiselling in a slant.

11.25 RED OR WHITE FINE DRESSED AND RUBBED SAND STONE FLOORING

11.25.1 Stone Slabs shall be as specified in 11.24.1

11.25. Dressing

The specifications for dressing the top surface and the sides shall be as described in CPWD Specification (vol.1) 2009 chapter 11. In addition the dressed top and sides shall be table rubbed with coarse grade carborundum stone before paving, to obtain a perfectly true and smooth surface free from chisel marks. The thickness of the slabs after dressing shall be as specified with a permissible tolerance of ± 2mm.

11.25.3 Laying

The slabs shall be laid with 3 mm thick or 5 mm thick joints as specified in the description of the item. Where the joints are to be limited to 3 mm thickness, the slabs shall be laid as specified in 11.20.3 except that the bedding mortar shall be as specified in 11.24.3 and sides of the slabs to be jointed shall be buttered with cement mortar 1:2 (1 cement: 2 stone dust) admixed with pigment to match the

shade of the slab. Where the slabs are to be laid with 5 mm thick joints, the specifications for laying shall be as described in 11.24.3

11.25.4 Finishing shall be as specified 11.24.4 except that chisel marks and unevenness shall be removed by rubbing with coarse grade carborundum stone.

12.1 **Roofing:** List of Bureau of Indian Standard Codes

S. No.	IS Codes	Subject
1	IS 73	Specification for paving Bitumen
2	IS 277	Galvanised steel sheets (plain and corrugated)
3	IS 1199	Methods of sampling and analysis of concrete
4	IS 1200(PTIX)	Method of measurements of building and civil engineering works: Part – 9 Roof covering (including cladding)
5	IS 1200(PTX)	Method of measurements of building and civil engineering works: Part -10 ceiling and lining
6	IS 2115	Code of practice for flat roof finish: mud phuska
7	IS 2645	Specification for integral water proofing compounds for cement mortar and concrete
8	IS 3007 (PT.1)	Code of practice for laying of asbestos cement sheets: part- 1 corrugated sheets
9	IS 3007 (PT.2)	Code of practice for laying of asbestos cement sheets part- 2 semi-corrugated sheets
10	IS 3384	Specification for bitumen primer for water proofing and damp proofing
11	IS 5382	Specification for rubber sealing rings for gas mains, water mains and sewers
12	IS 13592	Unplasticised polyvinyl chloride (UPVC) pipes for soil and Waste discharge system for inside and outside building.

12.1.1 **NON-ASBESTOS HIGH IMPACT POLY PROPYLENE REINFORCED CEMENT CORRUGATED SHEET ROOFING**

As per CPWD Specifications Vol.1 2009

12.1.2 Non-Asbestos High Impact Poly Propylene Reinforcement Cement Corrugated Sheets The sheets shall be of the approved quality and shall conform to IS 14871. The sheets shall be free from cracks, chipped edges or corners and other damages.

(a) General Composition of Sheets

The product shall be composed essentially of an inorganic hydraulic binder (see Note) or a calcium silicate binder formed by the chemical reaction of a silicate binder formed by the chemical reaction of siliceous (includes ground silica, pulverized fuel ash and amorphous silica) and calcareous material reinforced by organic fibres and/or inorganic synthetic fibres. Pozzolanic materials process aids, fillers and pigments which are compatible with the fibre reinforced cement may be added. The inorganic hydraulic binder shall be either 33 grade ordinary Portland cement conforming to IS 269 or 43 grade ordinary Portland cement conforming to IS 8112 or 53 grade ordinary Portland cement

conforming to IS 12269 or Portland pozzolana (fly ash based) cement conforming to IS 1489. (Part 1) or Portland pozzolana cement (calcined clay based) conforming to IS 1489 (Part 2) or rapid hardening cement conforming to IS 8041 or Portland slag cement conforming to IS 455. Fly ash used shall be conforming to IS 3812.

In case of Portland pozzolana cement and Portland slag cement, addition of Pozzolanic materials and slag shall not be permitted.

(b) Classification – Sheets may be classified according to thickness as under

Type A - The thickness of the sheets shall be approximately constant throughout the width of profile.

Type B - The thickness of the sheets shall vary regularly between the valley and the crown for corrugated sheets or between the lower part and the upper part of ribs for asymmetrical section sheets, in the same cross-section.The sheets shall be categorized based on height of corrugations, 'h' and minimum thickness 'e' as under:

Category and Class (Minimum Breaking Load N/m)

Category	Minimum Thickness	Class									
		1	2	3	4	5	6	7	8	9	10
A (15 mm < h< 55 mm)	3	600	800	1000	1400	-	-	-	-	-	-
B (25 mm < h<	4			1000	1400	2000	2500	3300	-	-	-
C (40 mm < h<	4.5	-	-	-	1400	2000	2500	3300	4250	-	-
D (60mm < h<	5.5	-	-	-	-	-	-	3300	4250	5600	7400

12.1.3 Slope

The roof shall not be pitched at flatter slope than 1 vertical to 5 horizontal. The normal pitch a dopted shall usually be 1 vertical to 3 horizontal.

12.1.4 Laying

12.1.4.1 The sheets shall be laid on the purlins and other roof members as indicated in the working drawings or as instructed by the Engineer-in-Charge.

12.1.4.2 The maximum spacing of purlins under the sheets shall be 1.40 metres in the case of 5.5 mm thick sheets and these shall in no case be exceeded. Ridge purlins shall be fixed at 75 mm to 115 mm from the apex of the roof.

12.1.4.3 The top bearing surfaces of all purlins and of other roof members shall be in one plane so that the sheets when being fixed shall not require to be forced down to rest on the purlins.

12.1.4.4 The sheets shall be laid with a side lap of half a corrugation and an end lap of 15 cm minimum in the case of roofs with a pitch flatter than 1 vertical to 2.5 horizontal (approx. 22 degree) or in the case of very exposed situations, the minimum permissible end lap shall be 20 cms. Side laps should be laid on the side facing away from the prevailing monsoon winds.

12.1.4.5 The free overhang of the sheets at the eaves shall not exceed 30 cm. corrugated sheets shall be laid from left to right starting at the eaves.

12.1.4.6 The 'Mitred' described above is necessary to provide a snug fit where four sheets meet at a lap. It is cut from a point 15 cm (or whatever the length of the end lap may be) up the vertical side of the sheet to a point 5 cm along the horizontal edge. This cutting may be done with an ordinary wood saw at site.

12.1.5 Fixing

12.1.5.1 Sheets shall be secured to the purlins and other roof members by means of 8 mm diameter polymer coated iron J or L hook bolts and nuts. W hile, J hooks are used for fixing to angle iron purlins, L hooks are used for fixing to R.S. joists, timber or precast concrete purlins.

The grip of the J or L hook bolt on the side of the purlin shall not be less than 25 mm. Each iron J or L hook bolt shall have a bitumen washer and a galvanised iron washer placed over the sheet before the nut is screwed down from above. On each purlin there shall be one hook bolt on the crown adjacent to the side lap on either side. Bitumen washer shall be of approved manufacture. Polymer coating of hooks, bolts and nuts shall be as per IS code14871.

12.1.5.2 The G.I. flat washer shall be 25 mm in diameter, 1.6 mm thick and the bitumen washer shall be 35 mm in diameter and 1.5 mm thick. The length of J bolt or crank bolt shall be as specified in Table 12.2 below.

TABLE 12.2

S.No.	Situation	No. of Bolts & Washers	Length of Bolts
1.	At horizontal (end) laps of Sheets. At eaves when filler pieces are used. At ridge when sheets and ridge pieces are secured by the same bolt.	Twice the No. of sheets in one horizontal course.	Depth of purlin plus 90 mm.
2.	At eaves when filler pieces are not used. At ridge when corrugated sheets and ridge pieces are not secured by the same bolt.	Twice the No. of sheets in the horizontal course.	Depth of purlin plus 75 mm.
3.	At intermediate purlins where horizontal laps do not occur.	Twice the No. of sheets in the horizontal course.	Depth of purlin plus 75 mm.

12.1.5.3 Each nut shall be screwed lightly at first. After a dozen or more sheets are laid, the nuts shall be tightened to ensure a leak proof joint.

12.1.5.4 Holes for hook bolts etc. shall be drilled and not punched, always through the crown of the corrugation and not in valleys, in locations to suit the purlins while the sheets are on the roof in their correct position. The diameter of holes shall be 2 mm more than the diameter of the fixing bolts. No hole shall be nearer than 40 mm to any edge of a sheet or any accessory.

12.1.6 Wind Ties

Wind ties may be provided where the situation justify their provision. These shall be of 40 × 6 mm flat iron section or of other size as specified. These shall be fixed at the eave ends of the sheets.

12.1.7 Finish

The completed roof shall present a neat and uniform appearance and be leak proof.

12.2 PAINTING OF ROOF SLAB WITH HOT BITUMEN

12.2.1 Preparing the surface

The surface shall be painted only when it is thoroughly dry. The surface to be painted shall be cleaned with wire brushes and cotton or gunny cloth. All loose materials and scales shall be removed and the surface shall be further cleaned with a piece of cloth lightly soaked in kerosene oil.

12.2.2 Painting with Bitumen

12.2.2.1 The contractor shall bring the bitumen to site in its original packing and shall open and use it in the presence of the Engineer-in-Charge or his authorized representative. The containers shall not be removed from the site until the painting job is completed and the Engineer-in-Charge has satisfied himself regarding the quantity of bitumen actually used and has given his permission to remove the empty containers.

12.2.2.2 The surface prepared and treated shall be painted uniformly with bitumen of approved quality such as residual type petroleum bitumen of penetration 80/100, hot cut back bitumen or equivalent as per specifications of the manufacturer. The coat of bitumen shall be continued 15 cm along the vertical surfaces joining the roof. In case of parapet walls it shall be continued upto the drip courses.

12.2.2.3 Residual type petroleum bitumen of penetration 80/100 shall be heated to a temperature of not less than 180 degree C and not more than 190 degree C and shall be applied on the roof surface at not less than 180 degree C. Similarly, hot cut back bitumen shall be heated to a temperature of not less than 165 degree C and not more than 170 degree C and shall be applied on the surface at not less than 165 degree C.

12.2.2.4 Care shall be taken to see that no blank patches are left. The quantity of bitumen to be applied per 10 square metres of roof surface shall be 17 kg, unless

otherwise stipulated in the description of the item. It shall be carefully regulated so that the application is uniform at the stipulated rate of 17 Kg. per 10 square metres.

12.2.3 Spreading Sand

Immediately after painting, dry, clean sharp coarse sand at the rate of 60 cubic decimeter per 10 sqm. shall be evenly spread and levelled over the surface when the bitumen is still hot.

12.3 MUD PHUSKA TERRACING WITH BRICK TILE PAVING

12.3.1 Mud Phuska

For mud phuska, selected soil which should be a good quality earth suitable for making bricks not containing excessive clay or sand, free from stones, kankar, vegetable matter and other foreign matter, shall be collected and stacked at site. The soil shall not be collected from a locality infested with white ants. Before laying on the roof, the soil shall be made damp by adding water about 12 hours earlier. It shall be turned over with phawaras so as to break clods and to pulverise the same. Quantity of water to be added to the soil shall be carefully regulated so that the soil shall have optimum moisture content at the time of laying and compaction on the roof. The soil shall be laid on the roof to requisite thickness and slope, well compacted with wooden rammers and thappies, to obtain an even surface to correct slope. Average thickness of soil after compaction shall be as specified for the item.

A practical way of determining the moisture content of soil suitable for giving good compaction is that the soil should contain that much quantity of moisture, which when a handful of soil is moulded with hand to the shape of a ball, it shall just retain its form.

12.3.2 Mud Plaster

After laying the mud phuska, the surface shall be given a coat of mud plaster 25 mm thick and the plaster shall be allowed to dry and crack. The mud plaster shall be prepared from the same soil as for mud phuska. The dry soil shall be reduced to fine powder and mixed with water in a pit, adding fibrous reinforcing materials such as chopped straw (Bhusa) in proportion of 35 kg per cum of soil. The mixture shall be allowed to mature for a period of not less than 7 days. During this period it shall be worked over with feet and spades (Phawaras) at intervals so as to get pugged into a homogeneous mass free from lumps and clods. The mud mortar shall be puddled again very thoroughly just before use.

The consistency of mud mortar shall be checked by taking it on a trowel and observing how it slides off the face of trowel. The mortar shall readily slide off the trowel and should not be so wet as to part on to large drops before falling. Alternatively slump test may be performed in accordance with IS 1199. The slump should be about 70 mm.

12.3.3 Gobri Leaping

After the mud plaster has dried, the surface should be given a coat of gobri leaping so as to completely fill any crack that may have formed in the mud plaster. Mortar for gobri leaping shall be prepared by mixing equal quantities of fresh gobar and finely sieved clay and adding sufficient water to form a thin paste. The quantity of gobar used in gobri leaping shall not be less than 0.03 cum per 100 sqm of plaster area. Five percent of cut back bitumen by mass of dry clay may be added to improve upon the water proofing qualities.

12.3.4 Laying of Bricks Tile

After the gobri leaping has dried, brick tiles shall be laid using the minimum amount of plain mud mortar (without bhusa) as bedding so as to obtain correct slope and even surface of tile floors. Care shall be exercised to see that mud mortar does not rise into the vertical joints of the tiles more than 12 mm. The brick tiles shall be either flat tile bricks of class designation 100 or machine moulded tile bricks of class designation 125 conforming to IS 2690 (Prt I) as per the nomenclature of the item. The tiles shall be laid such that the thickness of joints shall not be less than 6 mm and more than 12 mm in width. After the tiles are well set and bedding mortar has dried, joints of the tiles shall be grouted with cement mortar of mix 1:3 (1 cement:3 fine sand) such that all the joints of tiles are completely filled with mortar and the joints should be finished neat. Cement used for the mortar shall be mixed with 2% of integral water proofing compound which should conform to IS 2645.

12.3.5 Curing

As soon as cement grouting obtains initial set, the surface of the brick tile floor shall be covered with wet gunny bags, hessian cloth or wet sand to prevent quick drying. After 8-12 hours, the brick tile floor shall be cured by frequent sprinkling of water on the surface for a period of 7 days. After curing has been done, the surface shall be swept clean.

The tile surface as completed shall be even and true to slopes of 1 in 48 or as specified and should be leak proof.

When surplus earth of a suitable quality exists at the site of work, the contractor shall be allowed to use the same free of cost for laying the mud terracing, mud plaster and gobri leaping on the top. The Engineer-in-Charge shall be the final authority to decide whether the earth obtained from excavation is surplus to the requirements at site and is suitable for mud phuska work.

12.4 PAVING OVER MUMTY ROOFS WITH BRICKS TILE

The roofs shall be paved with bricks tile laid flat and grouted with cement mortar.

12.4.1 Bricks Tile

These shall conform to the specifications detailed in subhead 6.0 of brick work

12.4.2 Cement Mortar

The cement mortar shall be of 1:3 mix (1cement:3 fine sand) unless otherwise specified in the description of the item and shall conform to the specifications described in subhead 3.0 of Mortars.

12.4.3 Preparing the Surfaces

The surface shall be hacked, roughened and cleaned of all dust and other foreign matter. It shall then be wetted before applying the mortar.

12.4.4 Paving and Grouting

Cement mortar shall be spread in 12 mm layer over the surface evenly to required slope. Brick tiles which had been soaked as in brick work in water for at least an hour before hand shall then be laid open jointed and flat on the mortar and lightly pressed, and set to plane surface true to slopes etc. using a trowel and wooden straight edge. The brick tiles shall be laid with their joints not more than 10 mm wide. They shall be laid with their longitudinal lines of joints truly parallel and horizontal and at right angles to the sloping edges of the roof. Transverse joints in alternate rows should come directly in line with one another. Transverse joints in adjacent courses shall not have distance by less than 5 cm. As soon as the paving is done, the open joints shall be grouted with cement mortar 1:3 (1cement:3 fine sand). Cement used for grouting mortar shall be mixed with 2% (by unit of cement) water proofing compound conforming to IS 2645. Care shall be taken to see that no joints are left unfilled or inadequately filled. The joints shall be finished flush with the brick surface.

12.4.5 Curing

The tile paving shall be cured for at least 7 days during which period it shall be suitably protected from damage.

12.5 CEMENT CONCRET GOLA

12.5.1 Cement Concrete

The specifications for concrete shall be the same as described in subhead 4.0 of concrete work of CPWD specifications Vol-1.

12.5.2 Gola

A chase of 75 mm wide and 75 mm deep shall be cut in the parapet wall just above the junction of mud phuska or lime concrete with parapet wall and it shall be filled with cement concrete 1:2:4 (1 cement:2 coarse sand:4 stone aggregate 10 mm and down gauge) the external face finish with a slope of 1 0.75 and the exposed surface of the gola shall be plastered with cement mortar 1 3 (1 cement:3 fine sand). Expansion joint at every 3.5 to 4.5 metres shall be provided and filled with bitumen filler. The bitumen filler shall be prepared by mixing bitumen, cement and coarse sand in the ratio of 80:1:0.25 (80 kg of hot bitumen:1 kg of cement and 0.25 cum of coarse sand).

12.5.3 Curing

The finished surface shall be cured for at least 7 days.

12.5.4 Measurements

The length of the finished gola shall be measured at its junction with the wall face correct to a cm. No deduction shall be made in measurements for gaps for water outlets.

12.6 KHURRAS

The khurras shall be constructed before the brick masonry work in parapet wall is taken up and it shall be of size 45 cm x 45 cm unless otherwise specified in the description of the item and shall be made of cement concrete 1:2:4 mix (1 cement: 2coarse sand:4 graded stone aggregate 20 mm nominal size) or other mix as stipulated in the description of the item.

12.6.1 Laying

12.6.1.1 A PVC sheet of size 1 m x 1 m x 400 micron (alternatively, aluminium foil of 32 SW G) shall be laid under the khurra and then cement concrete shall be laid over it to average thickness of 50 mm with its top surface lower than the level of adjoining roof surface by not less than 50 mm.

12.6.1.2 The concrete shall be laid to a size greater than the stipulated size of the khurra in such a way that the adjoining terracing shall overlap the concrete on its three edges by not less than 7.5 cm. The concrete will slope uniformly from the edges to the outlet, the slope being as much as possible and in no case less than 20 mm cement concrete at the outlet. The concrete shall be continued at the same slope through the width of the wall into the outlet opening to ensure a water tight joint.

12.6.1.3 The khurras and the sides of the outlet shall then be rendered with 12 mm coat of cement plaster 1:3 mix (1 cement : 3 coarse sand) or other mix as stipulated in the description of the item. This shall be done when the concrete is still green and shall be finished. The sides of the khurras and sides of the outlet opening shall be well rounded. The size of the finished outlet opening shall be 10 cm wide and by 20 cm high or as directed by the Engineer-in-Charge.

12.6.1.4 In cases where rain water is to be disposed off through rain water pipes, iron grating shall be provided at the outlet as a safeguard against choking, if so directed by the Engineer-in-Charge. Iron gratings, shall be of overall size 20 × 25 cm. with an outer frame of 15 × 3 mm M.S. flat to which 4 Nos M.S. bars of 10 mm dia shall be welded in a vertical direction keeping equal clear spacing of 2.5 cm. or as directed by the Engineer in Charge.

12.7 RED OR WHITE SAND STONE ROOFING

12.7.1 Sand Stone Slabs

The stone slabs shall be hard, even, sound and durable and shall conform to standards as detailed in subhead 7.0 of stone work. Slabs shall have been sawn or chiselled in a plane parallel to the natural bed of the stone. The slabs shall be rough chisel dressed on the top so that the dressed surface shall not be more than 6 mm from a straight edge placed on it. The edges of the depressions or

projections shall be chisel dressed in a slant, so that surface does not have sharp unevenness. The sides shall also be chisel dressed to a minimum depth of 20 mm so that the dressed edges shall at no place be more than 3 mm from a straight edge butted against it. The thickness of the slab shall be uniform and as specified in the item with a permissible tolerance of 2 mm. The slabs shall be uniform in length, the length being 5 to 8 mm less than the centre to centre spacing of the supporting wooden Joists (Karries) or RCC battens. Unless the design require some other shape the slabs shall be rectangular.

The width of the slabs may vary unless otherwise stipulated. It shall not be less than 40 cm.

12.7.2 Rafter Spacing

The maximum spacing of rafters (karries) or RCC battens supporting the slabs shall not exceed figures given in Table 12.5.

TABLE 12.5

Thickness of Slab	Maximum Spacing of Rafters
40 mm	52.5 cm.
45 mm	60 cm.
50 mm	68 cm.

The bearing of slabs over the supporting rafts karries shall not be less than 30 mm. W here a raft karry supports a slab from one side only, the bearing of such slab shall be for full width of the rafts. For bearing over the wall, the stone slabs shall be bedded over a layer of cement mortar 1: 4 (1 cement: 4 fine sand) of thickness not less than 12 mm.

12.7.3 Laying

The slabs shall be washed clean and wetted before being laid. The stone slabs shall be jointed in cement mortar 1:4 (1 cement : 4 coarse sand). The width of joints shall not be more than 8 mm not less than 5 mm. The top joints shall be finished flush and ceiling joints pointed with the cement mortar 1:3 (1 cement : 3 fine sand).

12.7.4 Finish

The finished surface shall be truly levelled or slopped as shown in the plan or as directed by the Engineer-in-Charge.

12.7.5 Curing

The slabs and their joints shall be kept wet during progress of work and for 7 days after completion.

12.8 RAIN WATER SPOUTS

12.8.0 The sectional area of rain water spouts provided shall be generally at the rate of 1 square cm per 70 to 80 square decimetre of roof area drained. However in locations subject to excessive and high intensities of rainfalls, the area of spouts provided may be suitably increased to suit local conditions. No spout shall be less than 80 mm in diameter. The spacing of spouts shall be arranged to suit the position of openings in the wall.

12.8.1 Stone Ware Spouts

The spouts shall be 100 mm in diameters and 60 cm long.

12.8.1.1 The stone ware pipe shall be perfectly sound, free from fine cracks, imperfections of glazing etc. They must be straight cylindrical and of standard nominal diameter and length and depth of socket as given in IS 651. Full length of pipes shall be used on the work. They must be thoroughly salt glazed inside and outside shall generally conform to IS 651.

12.8.1.2 Fixing:

These shall be provided at the mouths of khurras and shall be fixed in cement mortar 1:3 (1 cement: 3 coarse sand) with the socket embedded in the masonry and the spigot end projectingoutside. The masonry alround the pipe and socket shall be thoroughly wetted and the holes shall be given a coat of cement mortar alround. The S.W. pipe shall then be inserted and fixed with a surround of mortar. In case the hole has become much larger than the size of the pipe, cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 12.5 mm nominal size) shall be used to fill in the annular space. The spouts shall slope downward at the rate of 1 in 6. The projection outside the wall shall be uniform and not less than 40 cm. The entrance into the pipe shall be smoothly rounded to meet the internal bore of the pipe to facilitate easy flow. Care shall be taken to ensure that the vertical plane through the centre line of the spouts is at right angles to the plane of the wall. Spouts in a row shall be true to line.

12.8.1.3 Measurements: Spouts shall be measured in numbers.

12.8.1.4 Rate:

The rate shall include the cost of all materials and labour involved in all the operations described above including scaffolding.

12.9 CAST IRON RAIN WATER PIPES

12.9.1 Cast Iron pipes

Pipes shall conform to IS 1230 and shall be perfectly, smooth and cylindrical, their inner and outer surfaces being as nearly as practicable concentric. These shall be sound and of uniform castings, free from laps, pin holes or other imperfections and shall be neatly finished and carefully fitted both inside and outside. The ends of pipes shall be reasonably square to their axes.

12.9.2 Dimensions

C.I. rain water pipes shall be of the dia specified in the description of the item and shall be in full length of 1.8 metre including socket ends of the pipes, unless shorter lengths are required at junctions with fittings. The pipe lengths shall be in each case be with socket. The pipes shall be supplied without ears unless otherwise specifically mentioned.

The pipes supplied shall be factory painted (with a tar base composition) both inside and outside which shall be smooth and tenacious.

Every pipe shall ring clearly when struck all over with a light hand hammer. When shorter pipes are cut from full lengths they shall be cut with a hacksaw. The sizes, weights, sockets and tolerances of pipes shall be as per Table 12.7 CPWD specification vol.1 2009 chapter 12

12.9.3 Fixing and Jointing

12.9.3.1 Pipes shall be either fixed on face of wall or embedded in masonry, as required in the description of the item.

12.9.3.2 Plain pipes (without ears) shall be secured to the walls at all joints with M.S. holder bat clamps. The clamps shall be made from 1.6 mm thick galvanized M.S. sheet of 30 mm width, bent to the required shape and size so as to fit tightly on the socket of the pipe, when tightened with screw bolts. It shall be formed out of two semi-circular pieces, hinged with 6 mm dia M.S. bolt on one side and provided with flanged ends on the other side with hole to fit by the screw bolt and nut, 40 mm long. The clamp shall be provided with a hook made out of 27.5 cm long 10 mm diameter M.S. bar, rivetted to the ring at the centre of one semi circular piece. The details of the clamps are shown in Fig 12.8. The clamps shall be fixed to the wall by embedding their hooks in cement concrete block 10 x 10 x 10 cm in 1:2:4 mix (1 cement:2 coarse sand: 4graded stone aggregate 20 mm nominal size) for which necessary holes shall be made in the wall at proper places. The clamps shall be kept about 25 mm clear off finished face of wall, so as to facilitate cleaning and painting of pipes.

Where G.I. sheet clamps are not provided, M.S. sheet clamps of 3 mm thick and 20 mm wide shall be used for making the clamps.

12.9.3.3 The pipes shall be fixed perfectly vertical or to the lines as directed. The spigot of the upper pipe shall be properly fitted in the socket of the lower pipe such that there is a uniform annular space for filling with the jointing material. The annular space between the socket and the spigot shall be filled with a few turns of spun yarn soaked in neat cement slurry. These shall be pressed home by means of caulking tool. More skins of yarn shall be wrapped if necessary and shall be rammed home. The joint shall then be filled with stiff cement mortar 1:2 (1 cement : 2 fine sand) well pressed with caulking tool and finished smooth at top at an angle of 45 degree sloping up. The joints shall be kept wet for not less than 7 days by tying a piece of gunny bag, four fold, to the pipe and keeping it moist constantly.

12.9.3.4 Where pipes are to be embedded in masonry, these shall be fixed in masonry work as it proceeds. In such cases care shall be taken to keep the pipes absolutely vertical or to the line as directed by the Engineer-in-Charge. The pipe shall have a surrounding of 12 mm minimum thickness of mortar at every portion of the external surface. The mortar shall be of the same mix as is used in the

masonry. The joint shall be caulked with lead as soon as the next length of pipe is placed in position.

The open end (socket end) of the pipe shall be kept closed till the next length is fitted and jointed, to prevent any brick bats or concrete or pieces of wood falling in and choking the pipe.

The depth of lead from the lip of socket shall be 25 mm minimum. In case of 100 mm dia. 75 mm and 50 mm pipes, the quantity of lead required per joint shall be 1.00 kg, 0.66 kg and 0.50 kg respectively for purpose of reckoning theoretical Consumption.

In order to ensure that required quantity of lead is poured into the joint and to control wastage of lead, at the beginning, three or four samples shall be made and the quantum of lead per joint approved by the Engineer-in-Charge.

The actual consumption of lead should be within ± 5% of the approved sample job subject to the provision that a variation of ± 20% shall be allowed over the theoretical quantity of lead due to dimensional tolerances allowed as per Indian Standards. This variation includes allowances of wastage also.

12.9.3.5 The spigot end shall butt the shoulder of the socket and leave no gap in between. The annular space between the socket and the spigot will be first well packed in with spun yarn leaving 25 mm from the lip of the socket for the lead. The joint shall then be lead caulked as described in detail under jointing of S.C.I soil, waste and vent pipes.

12.10 UNPLASTICISED POLYVINYL CHLORIDE PIPES AND FITTINGS

12.10.1 UPVC Pipes

Pipes shall conform to Type A pipes of IS 13592. The internal and external surfaces of the pipes shall be smooth and clean and free from groovings and other defects. The end shall be clearly cut and shall be square with the axis of the pipe. The end may be chamfered on the plain sides. Slight shallow longitudinal grooves or irregularities in the wall thickness shall be permissible provided the wall thickness remains within the permissible limit.

12.10.2 Colour of Pipe

Surface colour of the pipes shall be dark shade of grey or as specified.

12.10.3 Marking

Each pipe shall be clearly and indelibly marked with the following informations at intervals not more than 3 meter.

(a) Manufacturer‘s name or trade mark.

(b) Nominal outside dia of pipe. (c) Type ‘A’

(d) Batch number.

12.10.4 Dimensions

12.10.4.1 Diameter and Wall Thickness:

Mean outside diameter, outside diameter at any point and wall thickness for type –A manufactured plain or with socket shall be as given in Table- 1 of IS 13592.

UPVC rain water pipes shall be of the dia, specified in the description of the item and shall be in nominal lengths of 2,3,4 or 6 metres either plain or with sliding/grooved socket unless shorter lengths are required at junctions with fittings. Tolerances on specified length shall be + 10 mm and – 0 mm.

12.10.5 Fixing and Jointing

Pipes shall be either fixed on face of wall or embedded in masonry as required in the description of the item. Plain pipes shall be secured to the walls at all joints with PVC Pipes clips by means of 50 x 50 x 50 mm hard wood plugs, screwed with M.S. screws of required length i/c cutting brick work and fixing in cement mortar 1:4 (1 cement: 4 coarse sand). The clips shall be kept about 25 mm clear off finished face of wall, so as to facilitate cleaning of pipes. Pipes shall be fixed perfectly vertical or to the lines as directed. The pipes shall be fitted to fittings with seal ring conforming to IS 5382 allowing 10 mm gap for thermal expansion.

12.10.6 Installation in Wall/Concrete

The walls/concrete slots should allow for a stress free installation. Pipes and fittings to be inserted into the slots without a cement base have to be applied first with a thin coat of PVC solvent cement followed by sprinkling of dry sand (medium size). Allow it to dry. The process gives a sound base for cement fixation. This process is repeated while joining PVC material to CI/AC materials.

12.10.7 Fittings

Fittings used shall be of the same make as that of the PVC pipes Injeciton moulded or fabricated by the manufacturer and shall have a minimum wall thickness of 3.2 mm. The fittings shall be supplied with grooved socketted ends with square grooves and provided with Rubber Gasket conforming to IS 5382. The plain ends of the fittings should be chamfered. The fittings shall be joined with the help of Rubber lubricant. The details of fittings refer IS 13592.

12.11 CORRUGATED GALVANISED STEEL SHEET ROOFING

12.11.1 C.G.S. Sheets

These shall be of the thickness specified in the description of the item and shall conform to IS 277. The sheets shall be of 275 grade of coating (See Appendix-A of Chapter-12 of CPWD specifications Vol-1) unless otherwise specified in the description of item. The sheets shall be free from cracks, split edges, twists, surface flaws etc. They shall be clean, bright and smooth. The galvanising shall be non-injured and in perfect condition. The sheets shall not show signs of rust or white powdry deposits on the surface. The corrugations shall be uniform in depth and pitch and parallel with the side.

12.11.2 Purlins

Purlins of the specified material or M.S. rolled sections of requisite size shall be fixed over the principal rafters. These shall not be spaced at more than the following distances. (Table 12.1)

Thickness of C.G.S. sheet	Maximum spacing of purlins
1.00 mm	2.00 metre
0.80 mm	1.80 metre
0.63 mm	1.60 metre

The top surfaces of the purlins shall be uniform and plane. They shall be painted before fixing on top. Embedded portions of wooden purlins shall be coal tarred with two coats.

12.11.3 Slope

Roof shall not be pitched at a flatter slope than 1 vertical to 5 horizontal. The normal pitch adopted shall usually be 1 vertical to 3 horizontal.

12.11.4 Laying and Fixing

12.11.4.1 The sheets shall be laid and fixed in the manner described below, unless otherwise shown in the working drawings or directed by the Engineer-in-Charge.

12.11.4.2 The sheets shall be laid on the purlins to a true plane, with the lines of corrugations parallel or normal to the sides of the area to be covered unless otherwise required as in special shaped roofs.

12.11.4.3 The sheets shall be laid with a minimum lap of 15 cm at the ends and 2 ridges of corrugations at each side. The above minimum end lap of 15 cm shall apply to slopes of 1 vertical to 2 horizontal and steeper slopes. For flatter slopes the minimum permissible end lap shall be 20 cm. The minimum lap of sheets with ridge, hip and valley shall be 20 cm measured at right angles to the line of the ridge, hip and valley respectively. These sheets shall be cut to suit the dimensions or shapes of the roof, either along their length or their width or in a slant across their lines of corrugations at hips and valleys. They shall be cut carefully with a straight edge chisel to give a smooth and straight finish.

12.11.4.4 Lapping in C.G.S. sheets shall be painted with a coat of approved steel primer and two coats of painting with approved paint suitable for G.S. sheet, before the sheets are fixed in place.

12.11.4.5 Sheets shall not generally be fixed into gables and parapets. They shall be bent up along their side edges close to the wall and the junction shall be protected by suitable flashing or by a projecting drip course, the later to cover the junction by at least 7.5 cm.

12.11.4.6 The laying operation shall include all scaffolding work involved.

12.11.4.7 Sheets shall be fixed to the purlins or other roof members such as hip or valley rafters etc. with galvanized J or L hook bolts and nuts, 8 mm diameter, with bitumen and G.I. limpet washers or with a limpet washer filled with white lead as directed by the Engineer-in-Charge. While J hooks are used for fixing sheets on angle iron purlins, and L hooks are used for fixing the sheet to

R.S. joists, timber or precast concrete purlins. The length of the hook bolt shall be varied to suit the particular requirements.

The bolts shall be sufficiently long so that after fixing they project above the top of the nuts by not less than 10 mm. The grip of J or L hook bolt on the side of the purlin shall not be less than 25 mm. There shall be a minimum of three hook bolts placed at the ridges of corrugations in each sheet on every purlin and their spacing shall not exceed 30 cm. Coach screws shall not be used for fixing sheets to purlins.

12.11.4.8 The galvanized coating on J or L hooks, and bolts shall be continuous and free from defects such as blisters, flux stains, drops, excessive projections or other imperfections which would impair serviceability.

The galvanized coating should conform to IS 1367 (Pt. XIII) The mass of coating per square meter of the surface shall be as under:

Mass and Equivalent Thickness of Coating

Minimum Mass (g/m2)	Average thickness (µm)	Minimum Mass (g/m2)	Individual thinckness (µm)
375	54	300	43

12.11.4.9 Where slopes of roofs are less than 21.5 degrees (1 vertical to 2.5 horizontal) sheets shall be joined together at the side laps by galvanized iron bolts and nuts 25 × 6 mm size, each bolt provided with a bitumen and a G.I. limpet washer or a G.I. limpet washer filled with white lead. As the overlap at the sides extends to two corrugations, these bolts shall be placed zig-zag over the two overlapping corrugations, so that the ends of the overlapping sheets shall be drawn tightly to each other. The spacing of these seam bolts shall not exceed 60 cm along each of the staggered rows. Holes for all bolts shall be drilled and not punched in the ridges of the corrugations from the underside, while the sheets are on the ground.

12.11.5 Wind Tie

Wind ties shall be of 40 x 6 mm flat iron section or of other size as specified. These shall be fixed at the eaves of the sheets. The fixing shall be done with the same hook bolts which secure the sheets to the purlins. The ties shall be paid for separately unless described in the item of roofing.

12.11.6 Finish

The roof when completed shall be true to lines, and slopes and shall be leak proof.

12.12 RIDGES AND HIPS OF PLAIN GALVANISED STEEL SHEETS

12.12.1 Ridges and Hips

Ridges and hips of C.G.S. roof shall be covered with ridge and hip sections of plain G.S. sheet with a minimum lap of 20 cm on either side over the C.G.S. sheets. The end laps of the ridges and hips and between ridges and hips shall also be not less

than 20 cm. The ridges and hips shall be of 60 cm overall width plain G.S. sheet, 0.6 mm or 0.8 mm thick as given in the description of the item and shall be properly bent in shape.

12.12.2 Fixing

12.12.2.1 Ridges shall be fixed to the purlins below with the same 8 mm dia G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fix the sheets to the purlins.

12.12.2.2 Similarly, hips shall be fixed to the roof members below such as purlins, hip and valley rafters with the same 8 mm dia G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fix the sheets to those roof members. At least one of the fixing bolts shall pass through the end laps of ridges and hips, on either side. If this is not possible extra hook bolts shall be provided.

12.12.2.3 The end laps of ridges and hips shall be joined together with C.G.S sheet by galvanized iron seam bolts 25 x 6 mm size each with a bitumen and G.I. washer or white lead as directed by the Engineer-in-Charge. There shall be at least two such bolts in each end lap.

12.12.2.4 Surface of C.G.I. sheets of ridge and hip sections and the roofing sheets which overlap each other shall be painted with a coat of approved primer and two coats of approved paint suitable for painting G.S. Sheets before they are fixed in place.

12.12.3 Finish

The edges of the ridges and hips shall be straight from end to end and their surfaces should be plane and parallel to the general plane of the roof. The ridges and hips shall fit in squarely on the sheets.

13.1 Finishing: List of Bureau of Indian Standard Codes

S. No.	IS No.	Subject
1	IS 102	Ready Mixed Paint, Brushing, Red Lead, Non setting, Priming
2	IS 104	Specification for Ready Mixed Paint, Brushing, Zinc Chrome, Priming
3	IS 133	Enamel, Interior (a) Under Coating (b) Finishing
4	IS 419	Putty for Use On Window Frames
5	IS 427	Distemper, Dry Colour as Required
6	IS 428	Distemper, Oil Emulsion, Colour as Required
7	IS 712	Specification For Building Limes
8	IS 1200(Pt-XII)	Method of Measurements of Building and Civil Engineering Works:Part:XII — Plastering and Pointing
9	IS 1200(Pt-XIII)	Method of Measurements of Building and Civil Engineering Works:Part:XIII—White Washing, Colour Washing Distempering and Painting of Building Surfaces.

10	IS 1200(Pt-XV)	Methods of Measurements of Building and Civil Engineering Works : Part : XV — Painting, Polishing, Varnishing etc.
11	IS 2932	Enamel, Synthetic, Exterior (a) Undercoating, (b) Finishing
12	IS 5410	Cement Paint
13	IS 5411(Pt-1)	Plastic Emulsion : Paint Part I For Interior Use
14	IS 6278	Code of Practice For White Washing and Colour Washing

13.1 1 CEMENT PLASTER

The cement plaster shall be 12 mm, 15 mm or 20 mm thick as specified in the item.

13.1.2 Scaffolding

For all exposed brick work or tile work double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

13.1.3 Application of Plaster

13.1.3.1 Ceiling plaster shall be completed before commencement of wall plaster.

13.1.3.2 Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15×15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive troweling or over working the float shall be avoided.

No portion of the surface shall be left out initially to be patched up later on. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

13.1.4 Thickness

Where the thickness required as per description of the item is 20 mm the average thickness of the plaster shall not be less than 20 mm whether the wall treated is of brick or stone. In the case of brick work, the minimum thickness over any portion of the surface shall be not less than 15 mm while in case of stone work the minimum thickness over the bushings shall be not less than 12 mm.

13.1.5 Curing

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered.

13.1.6 Finish

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs.

13.1.7 Precaution

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer-in-Charge.

13.2 WHITE WASHING WITH LIME

13.2.1 For white washing the ceiling, proper stage scaffolding shall be erected.

13.2.2 Preparation of Surface

Before new work is white washed, the surface shall be thoroughly brushed free from mortar droppings an foreign matter.

Where efflorescence is observed the deposits may be brushed clean and washed. The surface shall then be allowed to dry for atleast 48 hours before white washing is done.

13.2.3 Preparation of Lime Wash

13.2.3.1 The lime wash shall be prepared from fresh stone white lime (Narnaul or Dehradun quality). The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm of gum dissolved in hot water, shall be added to each 10 cubic decimeter of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg of lime.

13.2.3.2 Indigo (Neel) upto 3 gm per kg of lime dissolved in water, shall then be added and stirred well. Water shall then be added at the rate of about 5 litres per kg. of lime to produce a milky solution.

13.2.4 Application

13.2.4.1 The white wash shall be applied with moonj brushes to the specified number of coats. The operation for each coat shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly one stroke horizontally from the right and another from the left before it dries.

13.3 COLOUR WASHING

13.3.1 The mineral colours, not affected by lime, shall be added to white wash. Indigo (Neel) shall however, not be added. No colour wash shall be done until a sample of the colour wash of the required tint or shade has been got approved from the Engineer-in-Charge. The colour shall be of even tint or shade over the whole surface. If it is blotchy or otherwise badly applied, it shall be redone by the contractor.

For new work, the priming coat shall be of white wash with lime or with whiting as specified in the description of the item. Two or more coats, shall then be applied on the entire surface till it represents a smooth and uniform finish.

For old work, after the surface has been prepared as described earlie a coat of colour wash shall be applied over the patches and repairs. Then a single coat, or

two or more coats of colour wash, as stipulated in the description of the item shall be applied over the entire surface. The colour washed surface shall present a uniform finish.

The finished dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

13.4 DRY DISTEMPERING

13.4.1 Materials

Dry distemper of required colour (IS427) and of approved brand and manufacture shall be used. The shade shall be got approved from the Engineer- in-Charge before application of the distemper. The dry distemper colour as required shall be stirred slowly in clean water using 6 decilitres (0.6 litre) of water per kg of distemper or as specified by the makers. W arm water shall preferably be used. It shall be allowed to stand for at least 30 minutes (or if practicable over night) before use. The mixture shall be well stirred before and during use to maintain an even consistency.

Distemper shall not be mixed in larger quantity than is actually required for one day‘s work.

13.4.2 Preparation of Surface

13.4.2.1 Before new work is distempered; the surface shall be thoroughly brushed free from mortar droppings and other foreign matter and sand papered smooth.

13.4.2.2 New plastered surfaces shall be allowed to dry completely, before applying, distemper.

13.4.2.3 In the case of old work, all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease, dirt, etc.

13.4.2.4 Pitting in plaster shall be made good with plaster of paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

13.4.3 Priming Coat

A priming coat of whiting shall be applied over the prepared surface in case of new work, if so stipulated in the description of the item. No white washing coat shall be used as a priming coat for distemper. The treated surface be allowed to dry before distemper coat is given.

13.4.4 Application

13.4.4.1 In the case of new work, the treatment shall consist of a priming coat of whiting followed by the application of two or more coats of distemper till the surface shows an even colour.

13.4.4.2 For old work, the surface prepared shall be applied one or more coats of distemper till the surface attains an even colour.

13.4.4.3 The application of each coat shall be as follows: The entire surface shall be coated with the mixture uniformly, with proper distemper brushes (ordinary white wash brushed shall not be allowed) in horizontal strokes followed immediately by vertical ones which together shall constitute one coat.

13.4.4.4 Enough distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room, which cannot be completed the same day.

13.4.4.5 Each coat shall be allowed to dry before the next one is applied.

13.4.4.6 For old work, after the surface has been prepared, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patches do not appear. The washing on ceiling should be done prior to that on walls.

13.5 OIL EMULSION (OIL BOUND) WASHABLE DISTEMPERING

13.5.1 Materials

Oil emulsion (Oil Bound) washable distemper (IS 428) of approved brand and manufacture shall be used. The primer where used as on new work shall be cement primer or distemper primer as described in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day‘s work shall be prepared.

13.6 CEMENT PRIMER COAT

Cement primer coat is used as a base coat on wall finish of cement, lime or lime cement plaster or on non-asbestos cement surfaces before oil emulsion distemper Paints are applied on them. The cement primer is composed of a medium and pigment which are resistant to the alkalies present in the cement, lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of oil emulsion distemper Paints.

Primer coat shall be preferably applied by brushing and not by spraying. Hurried priming shall be avoided particularly on absorbent surfaces. New plaster patches in old work should also be treated with cement primer before applying oil emulsion Paints etc.

13.6.1 Preparation of the Surface

The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any uneveness shall be made good by applying putty, made of plaster of paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.

13.6.2 Application

The cement primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before oil emulsion Paint is applied.

13.7 EXTERIOR PAINTING ON WALL

13.7.1 Material

The paint shall be (Textured exterior paint/Acrylic smooth exterior paint/premium acrylic smooth exterior paint) of approved brand and manufacture.

13.7.2 Preparation of Surface

For new work, the surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. should be repaired using white cement. The prepared surface shall

have received the approval of the Engineer in charge after inspection before painting is commenced.

13.7.3 Application

Base coat of water proofing cement paint.

13.7.3.1 All specifications in respect of base coat of water proofing cement paint shall be as described under ch-1 3 of CPWD specifications Vol- II.

13.7.3.2 Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given, First and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks.

13.7.4 The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described under ch-1 3 of C PW D specifications Vol-II.

13.8 PAINTING SYNTHETIC ENAMEL PAINT OVER G.S. SHEETS

Synthetic enamel: Paint, suitable for painting over G.S. sheets, of approved brand and manufacture and of the required shade shall be used. New or weathered G.S. sheets shall be painted with a priming coat of one coat of redoxide zinc chromate Paint. Primer shall be applied before fixing sheets in place.

13.8.1 Preparation of Surface

13.8.1.1 Painting New Surface: The painting of new G.S. sheets shall not usually be done till the sheets have weathered for about a year. When new sheets are to be painted before they have weathered they shall be treated with a mordant solution prepared by mixing 38 gm of copper acetate in a litre of soft water or 13 gm hydrochloric acid in a solution of 13 gm each of copper chloride, copper nitrate and ammonium chloride dissolved in a litre of soft water. This quantity of solution is sufficient for about 235 sqm. to 280 sqm of area and is applied for ensuring proper adhesion of Paint. The painting with the mordant solution will be paid for separately.

Before painting on new or weathered G.S. sheets, rust patches shall be completely cleaned with coarse emery paper and brush. All grease marks shall also be removed and the surface washed and dried and rusted surface shall be touched with synthetic enamel paint of approved brand, manufacturer and shade.

13.8.1.2 Painting Old Surface: If the old Paint is firm and sound, it shall be cleaned of grease, smoke etc. The surface shall then be rubbed down with sand paper and dusted. Rusty patches shall be cleaned up and touched with synthetic ename paint.

If the old Paint is blistered and flaked, it shall be completely removed . Such removal shall be paid for separately and painting shall be treated as on new work.

13.8.2 Application

The number of coats to be applied shall be as in the description of item. In the case of C.G.S. sheets, the crowns of the corrugations shall be painted first and when these get dried the general coat shall be given to ensure uniform finish over the entire surface without the crowns showing signs of thinning. The second or additional coats shall be applied when the previous coat has dried.

13.9 PAINTING CAST IRON RAIN WATER, SOIL, WASTE AND VENT PIPES AND FITTINGS

13.9.1 The primer shall be prepared on site or shall be of approved brand and manufacture as specified in the item. Paint shall be anti-corrosive bitumastic Paint, aluminum Paint or other type of Paint as specified in the description of the item.

13.9.2 Painting Surface

13.9.2.1 Preparation of Surface: The surface shall be prepared for priming coat as described in 13.24.2 of ch-13 of CPWD specifications Vol - II - 2009.

13.9.2.2 Application: The number of coat of painting over the priming coat shall be as stipulated in the description of the item. The application of Paint over priming coat shall be carried out as in ch-13 of CPWD specifications Vol - II - 2009.

13.10 PAINTING WITH WOOD PRESERVATIVE

13.10.1 Oil type wood preservative of specified quality and approved make, conforming to IS 218 shall be used. Generally, it shall be creosote oil type-I or anthracene oil.

13.10.2 Painting on New Surface

13.10.2.1 Preparation of Surface: Painting shall be done only when the surface is perfectly dry to permit of good absorption. All dirt, dust or other foreign matter shall be removed from the surface to be painted. All roughness shall be sand papered and cleaned.

13.10.2.2 Application: The preservative shall be applied liberally with a stout brush and not daubed with rags or cotton waste. It shall be applied with a pencil brush at the joints of the wood work. The first coat shall be allowed at least 24 hours to soak in before the second (the final) coat is applied. The second coat shall be applied in the same manner as the first coat. The excess of preservative which does not soak into the wood shall be wiped off with a clean dry piece of cloth.

13.10.3 Painting on Old Surface

The work shall be done in the same manner as on new surface except that only one coat shall be done.

13.11 REMOVING OLD PAINT

13.11.1 With Patent Paint Remover

13.11.1.1 Patent Paint removers shall consist of volatile organic liquids thickened with waxes and other ingredients to retard the evaporation of the liquid and to enable a substantial layer of remover to be applied to the surface.

The Paint remover shall be of a brand and manufacture approved by the Engineer- in-Charge. It shall be free from alkaline matter and non-caustic so that it can be handled by workmen without injury. It shall be of non inflammable quality as far as possible.

3.11.1.2 Application: Paint remover shall be used where burning off with blow lamp is not suitable. The Paint remover shall be applied liberally with a brush and allowed to remain on the surface for a period depending on the particular brand of remover used and on the thickness of the Paint coating to be removed. When the Paint film lifts and wrinkles under the action of the remover it shall be stripped with a sharp instrument. If the film is not thoroughly removed a second coat of remover may be applied if necessary over such patches and then the film thoroughly scrapped.

After the surface has been stripped, it shall be washed down with mineral turpentine to remove all traces of paraffin wax, which forms one of the ingredients of patent Paint remover and which if left in place will prevent the Paint from drying. The cleaned surface shall be suitably prepared for application of Paint or other finish.

13.11.2 With Caustic Soda Solution

13.11.2.1 Application: Caustic soda dissolved with 48 times its volume of water shall be applied to the old Paint with a brush and when the Paint film lifts and wrinkles it shall be thoroughly scrapped of in the same way as described in ch-13 of CPWD specifications Vol-II - 2009. After the surface has been stripped thoroughly, it shall be rinsed with several chances of clean water to remove all traces of alkali, which if allowed to remain are liable to spoil the new Paint applied over it. A little acetic acid or vinegar added to the final change of rinsing water helps to neutralize any remaining alkali.

14.1 Aluminum Work: List of Codes to be followed for Aluminum Works are as below

S. No.	IS Code	Subject
1.	IS 733	Wrought Aluminium and Aluminium Alloys, Bars, Rods and Sections
2.	IS 737	Wrought Aluminium and Aluminium alloy sheet and strip for general engineering purposes -
3.	IS 1285	Wrought Aluminium and Aluminium Alloy, Extruded Round Tube and Hollow sections (For General Engineering
4.	IS 1868	Anodic coating on Aluminium and its Alloys-Specification
5.	IS 1948	Specification for Aluminium Doors, Windows and Ventilators
6.	IS 3908	Specification for Aluminium equal leg angles
7.	IS 3909	Specification for Aluminium unequal leg angles
8.	IS 3965	Dimensions for wrought Aluminium and Aluminium
9.	IS 5523	Method of testing anodic coating on aluminium and its alloys.
10.	IS 6012	Measurement of coating thickness by Eddy Current Method
11.	IS 6315	Floor springs (Hydraulically regulated) for heavy doors-
12.	IS 6477	Dimensions of extruded hollow section and tolerances
13.	IS 12823	Wood products- Pre-laminated particle board –
14.	IS 14900	Transparent Float glass- Specifications.

14.2 PANELING MATERIAL

14.2.1 Pre-laminated Particle Board

A particles board laminated on both surfaces by synthetic resin impregnated base papers under heat and pressure. Pre-laminated particle boards shall be of two grades, namely, Grade I and II corresponding to IS 3087 & 12823.

14.2.1.1 Particle Board: Synthetic resin bonded flat pressed three layers, multilayer and graded particle board defined in IS 3087 having superfine surface shall be used for production of prelaminated particle board. For ECO Marks the particle board shall also conform to the requirements of ECO Mark specified in IS 3087.

14.2.1.2 Impregnated Base Paper: Printed or plain coloured absorbent base paper having a weight of 60-140 g/m2 impregnated in a suitable synthetic resin and dried to a volatile content of 4-8 per cent shall be used for pre-lamination on both surfaces of particle board.

14.2.1.3 Impregnated Overlay: An absorbent tissue, paper having a weight of 18-40 g/m in a suitable synthetic resin and dried to a volatile content of 4-8 per cent shall be used for the manufacture of pre-laminated particle board.

14.2.1.4 Finish: The finish of the paper overlaid board depends on the surface of caul plates used. Common surface finishes in use are glossy, matt textured (soft,

Swede, wood pore and leather), etc. The surface finish of the foil finished boards depends on the original finish of the foil used.

14.2.1.5 Dimensions and Tolerances: Dimensions and tolerances shall conform to IS 12049.

14.2.1.6 Testing: One sample for every 100 sqm. or part thereof shall be taken and testing done as per IS 12823. For quantity less than 100 sqm, the test certificate from manufacturer shall be relied upon. The Engineer-in-charge may ask for testing even if the quantity is less than 100 sqm.

14.2.2 Aluminium Sheet

14.2.2.1 Aluminium Sheets for use as panels shall be 1.25 mm thick aluminium alloy sheet conforming to IS 737. Aluminium alloy sheet for use in general paneling work shall be of types and thickness as specified and conforming to the requirement of IS 737. Aluminium sheets shall be of approved make and manufacturer. Aluminium panel may be prefabricated units manufactured on modular or non-modular dimension.

14.2.2.2 Fixing: The required size of panel, keeping sufficient margin to be inserted inside the section, shall be cut to correct size and fixed firmly in the frame with CP brass or aluminium or stainless steel screws of star headed, counter sunk and matching size groove. Joints sealed with epoxy resin or silicon sealant to make the unit water proof.

14.2.3 Float Glass

14.2.3.1 The glass shall be clear float glass and should be approved by the Engineer in Charge. It shall be clear, float transparent and free from cracks subject to allowable defects. The float glass shall conform to the IS 14900.

14.2.3.2 Thickness: The thickness of float glass shall depend on the size of panel. The tolerance in thickness shall be as under:

Nominal Thickness (in mm)	Tolerance (in mm)
4	± 0.3
5	± 0.3
6	± 0.3
8	± 0.6

14.3 EPDM-GASKETS:

The EPDM Gaskets shall be of size and profile as shown in drawings and as called for, to render the glazing, doors, windows, ventilators etc. air and water tight. Samples of gaskets shall be submitted for approval and the EPDM gasket approved by Engineer-in-Charge shall only be used.

14.4 SEALANT

14.4.1 The sealants of approved grade and colour shall only be used. The silicone for perimeter joints (between Aluminium section and RCC/Stone masonry) shall be of make approved by the Engineer in Charge.

14.4.2 Method of Application

Surface Preparation: Clean all joints and glazing pockets by removing all foreign matter and contaminants such as grease, oil, dust, water, frost, surface dirt, old sealants or glazing compounds and protective coatings.

14.4.3 Masking

Areas adjacent to joints shall be masked to ensure neat sealant lines. Masking tape shall not be allowed to touch clean surfaces to which the silicone sealant is to adhere. Tooling shall be completed in one continuous stroke immediately after sealant application and before a skin forms and masking shall be removed immediately after tooling.

14.4.4 Application

Install backer rod of appropriate size and apply silicone sealant in a continuous operation using a positive pressure adequate to properly fill and seal the joint. The silicone sealant shall be tooled with light pressure to spread the sealant against backing material and the joint surfaces before a skin forms. A tool with convex profile shall be used to keep the sealant within the joint. Soap or water shall not be used as a tooling aid. Remove masking tape as soon as silicone joint is tooled.

Tolerance: A tolerance of + 3 mm shall be allowed in the width of silicone joints. The depth of the joints at throat shall not be less than 6 mm.

14.5 DOOR, WINDOW, VENTILATOR AND PARTITION FRAMES

14.5.1 Frame Work: First of all the shop drawings for each type of doors/windows/ventilators etc. shall be prepared by using suitable sections based on architectural drawings, adequate to meet the requirement/ specifications and by taking into consideration varying profiles of aluminium sections being extruded by approved manufacturers. The shop drawings shall show full size sections of glazed doors, windows, ventilators etc. The shop drawings shall also show the details of fittings and joints. Before start of the work, all the shop drawings shall be got approved from the Engineer-in-Charge.

Actual measurement of openings left at site for different type of door/window etc. shall be taken. The fabrication of the individual door/windows/ventilators etc. shall be done as per the actual sizes of the opening left at site. The frames shall be truly rectangular and flat with regular shape corners fabricated to true right angles. The frames shall be fabricated out of section which have been cut to length, mitered and jointed mechanically using appropriate machines. Mitered joints shall be corner crimped or fixed with self tapping stainless steel screws using extruded aluminium cleats of required length and profile. All aluminium work shall provide for replacing damaged/broken glass panes without having to remove or damage any member of exterior finishing material.

14.5.2 Fixing of Frames: The holes in concrete/masonry/wood/any other members for fixing anchor bolts/fasteners/screws shall be drilled with an appropriate electric drill. Windows/doors/ventilators etc. shall be placed in correct final position in the opening and fixed to Sal wood backing using stainless steel screws of star headed, counter sunk and matching size groove. of required size at spacing not more than 250 mm c/c or dash fastener. All joints shall be sealed with approved silicone sealants.

In the case of composite windows and doors, the different units are to be assembled first. The assembled composite units shall be checked for line, level and plumb before final fixing is done. Engineer-in-Charge in his sole discretion may allow the units to be assembled in their final location if the situation so warrants. Snap beadings and EPDM gasket shall be fixed as per the detail shown in the shop drawings. Where aluminium comes into contact with stone masonry, brick work, concrete, plaster or dissimilar metal, it shall be coated with

an approved insulation lacquer, paint or plastic tape to ensure that electrochemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion. The contractor shall be responsible for the doors, windows etc. being set straight, plumb, level and for their satisfactory operation after fixing is complete.

14.5.3 **Measurements:** All the aluminium sections including snap beadings fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment (weight shall be taken after anodizing). The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts.

14.6 DOOR, WINDOWS AND VENTILATOR SHUTTERS

Material, fabrication and dimensions of aluminium doors, windows and ventilators manufactured from extruded aluminium alloy sections of standard sizes and designs complete with fittings, ready for being fixed into the building shall be as per IS 1948.

14.6.1 Standard Sizes, Tolerances and Designations

Their sizes are derived after allowing 1.25 mm clearances on all the four sides for the purpose of fitting the doors, windows and ventilators into modular openings.

14.6.2 Tolerances

The sizes for doors, windows and ventilators frames shall not vary by more than ±1.5 mm.

14.6.3 Material

Aluminium alloy extruded sections used in the manufacture of extruded window sections shall conform to IS 733. Hollow aluminium alloy sections used shall conform to IS 1285.

14.6.4 Glass Panes

Glass panes shall weigh at least 7.5 kg/m2 and shall be free from flaws, specks or bubbles. All panes shall have properly squared corners and straight edges.

14.6.5 Screws

Screws threads of machine screws used in the fabrication of aluminium doors, windows and ventilators shall conform to IS 1362.

14.6.6 Fabrication

Frames: Frames shall be square and flat, the corners of the frame being fabricated to a true right angle. Both the fixed and opening frames shall be constructed of sections which have been cut to length, mitered and welded at the corners. Where hollow sections are used with welded joints, argon-arc welding or flash butt welding shall be employed (gas welding or brazing not to be done). Subdividing bars of units shall be tenoned and riveted into the frame.

14.6.7 Side-hung Shutters

For fixing aluminium alloy hinges, slots shall be cut in the fixed frame and the hinges inserted inside and may be riveted to the frame. The aluminium alloy for cast hinges shall conform to IS Designation A-5-M of IS 617. Specification for Aluminium and Aluminium Alloy Ingots and Castings for General Engineering Purpose and for extruded section of hinges to IS Designation HE10-WP or HE30-WP of IS 733. The pins for hinges shall be of stainless steel of non-magnetic type or aluminium alloy HR30. Irrespective of hinges being anodized or

not, the aluminium alloy pins shall be anodized to a minimum film thickness of 0.025 mm shall be sealed with oil, wax or lanolin. Non- projecting types of hinges may also be used where ever required. Frictions hinges may be provided for side-hung shutter windows, in which case peg stay may not be required.

14.6.8 The handle for side-hung shutters shall be of cast aluminium conforming to IS Designation A-5-M of IS 617 and mounted on a handle plate welded or riveted to the opening frame in such a way that it could be fixed before the shutter is glazed. The handle should have anodized finish with minimum anodic film thickness of 0.015 mm. The handle shall have a two points nose which shall engage with an aluminium striking plate on the fixed frame in a slightly open position as well as in a fast position. The height of the handles in each type of side-hung shutters shall be fixed in approximate position.

14.6.9 The peg stay shall be either of cast aluminium conforming to IS 617 or folded from IS Designation NS4 aluminium alloy sheet conforming to IS:737 specification for wrought aluminium and aluminium alloys, Sheet and strip. It shall be 300 mm long, complete with peg and locking brackets. The stay shall have holes for keeping the shutter open in three different positions. The peg and locking bracket shall be riveted or welded to the fixed frame.

14.6.10 Alternatively, and if specifically required by the purchaser, side-hung shutters may be fitted with an internal removable fly screen of 0.375 mm wire and equivalent to IS Sieve 100 in a 0.900 mm aluminium alloy sheet conforming to IS Designation NS3- 1/2H of IS 737 applied to the outer frame of the shutter by case or extruded aluminium alloy turn-buckle at the jambs and by aluminium or plated bronze shoes at the sill to allow of the screen being readily removed, and with a rotor operator at the sill to permit the operation of the shutter through an angle of 90º . On fly-screened shutters the peg stay is omitted and the normal handle shall be replaced by a locking handle to hold the shutter in the fast position.

14.6.11 **Doors:** The outer fixed frame shall be of section A1-FX8. The kick panels shall be of 1.25 mm aluminium alloy sheet conforming to IS Designation NS3-1/2H of IS 737 specification for Wrought Aluminium and Aluminium Alloys, Sheet and strip and shall be screwed to the frame and the glazing bar.

Hinges–Cast of extruded aluminium alloy hinges for doors shall be of the same type as in the windows but of larger size. The hinges shall normally be of the 50 mm projecting type. Non-projecting type of hinges may also be used. In double shutter doors the first closing shutter shall have a concealed aluminium alloy bolt at top and bottom. It shall be so constructed as not to work loose or drop by its own weight. Single and double shutter doors may be provided with a three-way bolting device. Where this is provided in the case of double shutter door, concealed aluminium bolts may not be provided.

14.6.12 **Weather Bar:** Where a coupling member is fitted over an external opening shutter, the coupling member should incorporate an integrally extruded weather bar.

14.6.13 **Position of Bolts, Fixing Screws and Lugs**

Outer frames shall be provided with fixing holes centrally in the web of the sections in the position. Moreover, any steel lugs coming in contact with aluminium should be either galvanized or given one coat of bituminous paint.

14.6.14 **Finish:** Alumiumum doors, windows and ventilators may be supplied in either matt, scratch-brush or polished finish. They may, additionally, also be anodized, if so required by the Engineer-in-charge. If colour anodizing is to be done then only approved light-fast shades should be used. A thick layer of clear transparent lacquer based on methacrylates or cellulose butyrate, shall be applied on aluminium doors, windows and ventilators by the supplier to protect the surface from wet cement during installation. This lacquer coating shall be removed after installation is completed.

14.6.15 **Glazing:** Glazing shall be provided on the outside of the frames. If required, glazing clips may be provided as extra fittings. Four glazing clips may be provided per glass pane, except for door type 8HS21 where the glazing clips shall be six per glass pane. In case of doors, windows and ventilators without horizontal glazing bars the glazing clips shall be spaced according to the slots in the vertical members, otherwise the spacing shall be 30 cm.

14.7 FITTINGS

14.7.1 Stainless Steel Friction Stay

The stainless steel friction stays of make approved by the Engineer-in-Charge shall be used. The SS friction stays shall be of grade AISI-304 and of sizes specified in nomenclature of item.

14.7.2 Lockable Handles

The lockable handle shall be of make approved by the Engineer-in-Charge and of required colour to match the colour of powder coated /anodized aluminium window sections.

14.7.3 Hydraulic Floor Spring

The hydraulic floor spring shall be heavy duty double action floor spring of make approved by the Engineer-in-Charge suitable for door leaf of weight minimum 100 kg. The top cover plate shall be of stainless steel, flushing with floor finish level. The contractor shall cut the floor properly with stone cutting machine to exact size & shape. The spindle of suitable length to accommodate the floor finish shall be used. The contractor shall give the guarantee duly supported by the company for proper functioning of floor spring at least for 10 years.

14.7.4 Tubular Handle

The tubular handle bar shall be aluminium polyester powder coated minimum 50 micron to required colour/anodized AC 15. Outer dia of tube shall be 32 mm, tube thickness 3.0 mm and centre to centre length 2115 mm + 5 mm.

14.8 BRASS LOCK

This should generally conform to IS-2209. The size of the lock shall be denoted by the length of the body towards the face and it shall be 100 mm. the measured length shall not vary more than 3 mm from the specified length. Ordinary lever mechanism with not less than 2 levers shall be provided. False lever shall not be used. Lever shall be fitted with one spring of phosphor-bronze or steel wire and shall withstand the test as provided in IS-2209. Locking-bolt spring and strike plate shall conform to IS 2209. Two keys shall be provided with each lock.

15.1 Water Supply Work:

List of Codes to be followed for Sanitary Installation Works are as below:

Sl. No.	IS Code	Subject
1.	IS 73	Paving Bitumen Specifications
2.	IS 702	Specifications for Industrial Bitumen
3.	IS 1322	Specifications for Bitumen felts for Water Proofing and Damp Proofing.
4.	IS 2645	Specifications for Integral Cement Water Proofing Compounds
5.	IS 3370(Part-1)	Code of Practice for Concrete Structures for the Storage of Liquid: Part - 1 General Requirements
6.	IS 3384	Specifications for Bitumen Primer for Water Proofing and Damp Proofing
7.	IS 7193	Specification for Glass Fibre Bitumen Felts
8.	IS 12200	Provision of Water Stops at Transfers Construction Joints in Masonry and Concrete Dams - Code of Practice.
9.	IS 12432(Part-3)	Application for Spray Applied Insulation - Code of Practice Part-3 Polyurethane/ Polyisocyarurate

15.2 INTEGRAL CEMENT BASED TREATMENT FOR WATER PROOFING ON HORIZONTAL SURFACE OF UNDER-GROUND STRUCTURE AT ALL DEPTH

15.2.1 Water Proofing of Horizontal Internal Surfaces of Under-ground Structure

(i) Preparation of Surface

The surface of levelling course should be roughened properly when the concrete is still green. In case the surface is not made rough before the concrete is set, the work of water proofing should not be executed till proper key is provided for the base layer of Cement Mortar 1:3

(ii) Blending Cement/Water with Water Proofing Compound

The required quantity of cement bags to be used for a particular portion of work should be emptied on a dry platform. Water proofing compound bearing ISI mark and conforming to IS 2645 should then be mixed properly with the cement. The quantity of water proofing compound to be mixed should be as prescribed by the manufacturer but not exceeding 3% by weight of cement. The quantity of cement and water proofing compound thus mixed should be thoroughly blended and the blended cement should again be packed in bags. For the water proofing compound in liquid form, the blending is to be done with water. This can be done by taking the just required quantity of water to be mixed in the particular batch of dry cement mortar.

(iii) Rough Kota Stone 22 to 25 mm Thick

The stone slabs to be used for this item shall be in thickness of 22 mm to 25 mm. Larger size of stone slabs i.e. 550 mm x 550 mm or 550 mm x 850 mm shall be used to minimise the number of joints.

General requirement of Kota stone shall be as laid down in CPWD Specifications of Kota Stone flooring.

(iv) Preparation of Cement Slurry

Cement slurry shall be prepared by using 2.2 kg of blended cement per sqm. area. Each time only that much quantity shall be prepared which can be covered on the surface and the surface in turn would be covered with 25 mm thick cement mortar

base within half an hour. Slurry prepared and remained unused for more than half an hour shall be totally rejected.

(v) Preparation of Cement Mortar

Cement mortar 1:3 (1 blended cement: 3 coarse sand) shall be prepared with cement/ water duly blended as explained in clause 23.2.1 (ii). Only that much quantity of cement mortar which can be consumed within half an hour, shall be prepared.

(vi) Laying Water Proofing Course

Before laying the base course of cement mortar 1:3, the lean concrete surface shall be cleaned neatly with water. Cement slurry prepared as per clause 23.2.1 (ii), shall be applied only on the area of the concrete surface, that can be covered with the cement mortar (1:3) base course within half an hour. The cement slurry should cover every spot of the surface and no place shall remain uncovered. Just after the application of cement slurry on the surface, the cement mortar prepared as per clause 23.2.1 (v) should be used for laying the base course. Base Course should be laid to a perfect level with wooden/aluminium straight edge of at least 2 mtrs. long. The top surface of cement mortar should be finished neatly and later scratched when green with a suitable instrument before the base course dries and gets hard that is just before the base course takes up initial set. Immediately on applying cement slurry on the base course the Rough Kota Stone slab shall be laid over the base course and pressed gently so that the air gap can be removed. The slurry applied on the surface which gets spread when the stone slab is pressed shall get accumulated in the joints of adjacent stone slabs and if any gap still remains between the stone slabs the same should also be filled with additional quantity of cement slurry. After filling all the joints of the Rough Kota stone Slabs with cement slurry the area of stone slab shall be laid with cement mortar 1:3. The surface of stone slabs shall be cleaned and lightly watered. Cement mortar 1: 3 prepared as per clause 23.2.1 (iv) shall be used for laying this course. For laying this course 25 mm high wooden strips shall be used and the top surface shall be finished smooth without using additional cement or slurry. After laying 3rd course and before the mortar layer takes the initial set, Stone aggregate of 10 mm to 12 mm nominal size shall be uniformly spread and lightly pressed into the finished surface @ 8 cudm./sqm. The aggregates shall not be embedded totally inside the mortar and shall be visible on the top surface. In cases where slope is to be provided for the water proofing layer, grading with additional cement concrete/cement mortar shall be provided and then the water proofing layer shall be laid on the graded surface. Extra payment shall however be made for the grading course.

(vii) Curing: Immediately after completing the fourth layer, arrangements shall be made for the top RCC slab as quickly as possible and in the mean time till the top slab is casted the water proofing treatment shall be kept wet continuously. In case the concreting of slab gets delayed for more than 2 weeks the curing can be stopped after 14 days.

(viii) Measurement: Length and breadth shall be measured along the finished surface correct to a cm and the area shall be worked out to nearest 0.01 sqm.

15.2.2 Water Proofing of Internal Horizontal Surfaces of Under-ground Structure

Same as in 23.2.1 above except that water proofing courses will be laid on R.C.C. Slab.

15.3 WATER PROOFING TREATMENT IN SUNKEN PORTION OF WCs, BATHROOMS ETC.

15.3.1 Preliminaries to be Attended

The preliminaries shall be attended as described in CPWD specifications Vol-II,2009, chapter-22.

15.3.2 Preparing Surface, Fixing Pipes and Fittings

In this case, unlike as described in CPWD specifications Vol-II,2009, chapter-22, no hacking of surface need be made, but only extra mortar sticking to the surface should be removed and the surface should be cleaned thoroughly. Fixing ⎓P' trap etc. shall be done as described in Clause 22.3.2 in CPWD specifications Vol-II, chapter-22.

15.3.3 Providing and Laying of Slurry for First Layer

The consistency of the slurry should be such as to cover the desired area by using 0.488 kg of blended cement per sqm of area. On deciding the correct quantity of water required per sqm. area the required quantity of slurry should be prepared which can be applied over the desired surface within half an hour of mixing with 0.488 kg. of grey cement + 0.253 kg. water proofing compound as per manufacturer specifications + x litres of water per sqm. area and the required quantity of slurry thus prepared should only be used for first application. The first layer shall be applied with painting brushes over the specified and dampened area carefully including the corners, holes on the surfaces and joints of pipes in concrete etc. and the application should continue at least upto 150 mm height of fixtures of pipes from the surface. The surface on application shall be air cured for 4 hours.

15.3.4 Providing and Laying of Slurry for Second Layer

The quantity of slurry required for second application to be covered within an hour of mixing shall be prepared with 0.242 kg. cement + 0.126 kg. water proofing compound + y litres of water per sqm. Area and the required quantity of slurry thus prepared should only be used for second application.

The application of 2nd layer of slurry is same as for first layer as detailed above. The applied surface shall be allowed to air cure for 4 hours and thereafter water curing shall be done for full 48 hours.

15.3.5 Measurement

Length and breadth shall be measured along the finished surface correct to a cm and area shall be worked out to nearest 0.01 sqm.

15.4 WATER PROOFING TREATMENT ON ROOF SLABS

15.4.1 Before taking up the water proofing work the construction of parapet walls, including finishing should be completed. Similarly, the ancillary items like haunches, khurras, grooves to tack the fibre cloth layer, fixing up of all down take pipes, water pipes and electric conduits etc. should be completed and no such work should be allowed on the area to be treated during the progress of water proofing treatment or even later.

15.4.2 Preparing Surface

There is no necessity of hacking the surface but the surface to be treated shall be cleaned including removing the mortar dropping from the surface.

15.4.3 Providing and Laying of Cement Slurry

The procedure to prepare and apply the cement slurry shall be same as detailed in clause 22.5.3 given in CPWD specifications Vol-II,2009, chapter-22,except that

over projected pipes etc. slurry shall be applied just upto 100 mm height instead of 150 mm height. The slurry shall be applied upto a height of 300 mm on parapet walls and in the groove where the fibre glass cloth is to be tucked.

15.4.4 Providing and Laying of Fibre Glass Cloth (2nd Layer)

The fibre glass cloth shall be of approved brand and shall be thin, flexible uniformly bonded mat composed of chemically resistant borosilicate glass fibre distributed in random open porous structure bonded together with a thermosetting resin. Immediately on applying the slurry on a sufficiently workable area as detailed above in CPWD specifications Vol-II, chapter-22. When the slurry applied is still green the fibre glass as specified shall be spread evenly on the surface without any kink and pressed in such a way that no air spaces exist. The fibre glass cloth shall be taken upto a height of 30 cm on parapet walls and tucked in the groove specially prepared at that height. A minimum overlap of 100 mm width shall be provided when the fibre cloth has to be joined. The joining of 100 mm overlap shall be done with the same slurry used for the application on surface as first layer. The fibre cloth shall also be extended upto a height of 100 mm over pipes projecting from the surface.

15.4.5 Providing and Laying of Cement Slurry for Third Layer

The quantity of water required to prepare slurry which can cover one sqm. area of the surface to be treated shall be calculated as described in clause 22.5.3 in CPWD specifications Vol-II,2009, chapter-22and consider this quantity as say x litres/sqm.On deciding the correct quantity of water required, the slurry shall be prepared by mixing 1.289 kg/m2 of grey cement + 0.67 kg./sqm. of Water Proofing Compound +1.289 kg./sqm. of coarse sand + x litres of water. Slurry shall be prepared for the area to be covered within ½ an hour of mixing.The consistency of the slurry shall be such that in one application with a brush 1.5 mm thickness of slurry can be coated on the fibre glass cloth surface. This slurry shall be applied evenly on the entire surface covered with fibre glass cloth so that a layer of 1.50 mm thickness of slurry is formed. The application of slurry shall be continued over the 300 mm portion of parapet wall and also the portion tucked in the groove on top. The entire surface shall be allowed for air curing for 4 hours and later the surface shall be cured with clean water for 7 days.On completion of curing the grooves where the fibre glass cloth is tucked shall be closed neatly with cement mortar mixed with water proofing compound and the repaired surface should be cured by clean water for 7 days. Fourth and final layer of brick tiling if required shall be laid and paid for separately.

15.4.6 Measurement: Length and breadth shall be measured along the finished surface correct to a cm and area shall be worked out to nearest 0.01 sqm. Overlaps and tucking in a flashing grooves shall not be measured. No deductions shall be made for openings or recess or chimney stack, roof lights or Khurras of area upto 0.40 sqm, nor anything extra shall be paid for forming such openings, recess etc. For area exceeding 0.40 sqm. deduction will be made in the measurement for the full opening and nothing extra shall be paid for making such opening.

15.5 WATER PROOFING TREATMENT WITH BITUMEN FELT

15.5.1 Water proofing treatment with self finished felt shall be four courses or six courses as described in the item. Four course water proofing treatment with self finished felt is a normal duty treatment suitable for buildings where the cost of roof

treatment is required to be restricted. Six course water proofing treatment with self finished felt is a heavy duty treatment suitable for important structures.

15.5.2 Materials

15.5.2.1 Self finished felt (Appendix A and B) shall conform to the type and grade given in the description of the item. This shall be one of the following types:

(i) Type 3 grade 1 hessian base felt conforming in all respects to IS 1322.

(ii) Type 2 grade 1 fibre base bitumen felt conforming to IS 1322.

(iii) Type 2 grade 2 glass fibre base felt conforming in all respects to IS 7193.

15.5.2.2 **Bonding Materials:** This shall consist of blown type petroleum bitumen conforming to IS 702 or residual petroleum bitumen conforming to IS 73. The bonding material shall be so selected as to withstand the local condition of temperature and gradient satisfactorily. The penetration of bitumen used shall not exceed 40 in any case. Suitable residual type petroleum bitumen of penetration 30/40 (IS grade S-35), residual type petroleum bitumen with higher penetration and low softening point and suitable blown type petroleum bitumen of IS grade 85/25 or 90/15 of approved quality shall be used. Where proprietary brands of bonding materials are proposed to be used they shall conform in all respects to the specifications in the preceding paras.

15.5.2.3 **Stone Grit and Pea-sized Gravel:** Stone grit shall be 6 mm and down size. Where pea-sized gravel is used it shall be hard, round and free from dust, dirt etc. The stone grit or pea-sized gravel shall not be spread over vertical and sloping faces of flashings and at drain mouths. At these places the surface shall be painted with two coats of bituminous solution.

15.5.3 Preparation of Surface

15.5.3.1 The surface to be treated shall have a minimum slope of 1 in 120. This grading shall be carried out with cement concrete or cement plaster with coarse sand, as per direction of Engineer-in-charge, to the average thickness required and finished smooth. Such grading shall be paid for separately.

15.5.3.2 Junctions between the roof and vertical faces of parapet walls, chimneys etc. shall be cased by running triangular fillets 7.5 x 7.5 cm size, in cement concrete. At the drain mouths, the fillets shall be suitably cut back and rounded off for easy application of water proofing treatment and easy flow of water. Cement concrete where used shall be 1:2:4 mix (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size). The provision of fillets shall be deemed to be covered by the item of water proofing and shall not be measured or paid for separately.

15.5.3.3 While the grading of roof surface is being done, it shall be ensured that the outlet drain pipe have been fixed and mouth at the entrance have been eased and rounded off properly for easy flow of water.

15.5.3.4 When any pipe passes through the roof to be treated, angular fillet shall be built around it for the water proofing treatment to be taken over it. These fillets shall not be measured or paid for separately.

15.5.3.5 For carrying over and tucking in the water proofing felts into the parapet walls, chimney stacks etc. a horizontal groove 6.5 cm deep, 7.5 cm wide section with its lower edge at not less than 15 cm above the graded roof surface shall be left on the inner face of the same during construction if possible. When such groove has not been left, the same shall be cut out neatly and the base at rear of the groove

shall be finished smooth with cement plaster 1:4 (1 cement: 4 coarse sand). Such cutting of the groove and its finishing smooth shall be deemed to be part of the water proofing item and shall not be measured or paid for separately. No deduction shall be made either for not making the groove or when the later has already been left in the masonry by the construction agency.

15.4.2.6 Tucking in the water proofing felt will be required where the parapet wall exceeds 45 cm in the height from the graded surface. Where the height is 45 cm or less, no groove will be required as the water proofing treatment will be carried over the top of the parapet wall to its full thickness. In the case of low dividing walls of height 30 cm or less, outlets therein shall be cut open for full height and the bottom and sides shall be rendered smooth and corners rounded and such treatment shall not be measured and paid for separately.

15.4.2.7 Where expansion joints are left in the slab, the provision of dwarf walls and/or RCC slabs for covering them and finishing the surface smooth shall be the responsibility of the construction agency, which had laid the roof slab and will not be included the operation of water proofing.

15.4.2.8 The graded surface of the roof and concrete fillets and the faces of walls shall be thoroughly cleaned with wire brushes and all loose scales etc. removed. The surface shall then be dusted off. Any crack in the roof shall be cut to 'V' section, cleaned and filled up flush with cement mortar slurry 1:4 (1 cement: 4 coarse sand) or blown type petroleum bitumen of IS grade 85/25, or approved quality conforming to IS 702. Such cleaning of the surface or treating the cracks shall not be paid for separately.

15.4.3 Priming Coat

Where so specified, or required by the Engineer-in-Charge for example under slightly damp conditions a priming coat consisting of a bitumen primer conforming to IS 3384 should be applied with brush on the roof and wall surface at 0.24 litres per sqm to assist adhesion of the bonding material (i.e. bitumen). Such application of primer shall be paid for separately, unless specifically included in the water proofing item.

15.5.4 Underlay:

Where a floating treatment of water proofing with self finished bitumen felt is required i.e. where water proofing treatment is required to be isolated from the roof structure, a layer of bitumen saturated felt (underlay) shall be spread over the roof surface and tucked into the flashing groove. No bonding material shall be used below the underlay in order to keep the underlay free of the structure. The adjoining strips of the underlay shall overlap to a minimum of 7.5 cm at sides and 10 cm at ends. The overlaps shall be sealed with the same bonding material as used for the self finished felt treatment. Unless specifically included in the water proofing item, the underlay treatment shall be paid for separately. The underlay shall be of type 1 saturated felt conforming to IS 1322 in all respects and having a total minimum weight of the finished bitumen felt in dry condition with mica dusting powder @ 6.8 kg per 10 sqm. The roll shall not be damaged or crack on being unrolled on a fairly smooth and flat surface.

15.5.5 Treatment

15.4.5.1 The water proofing shall consist of a four or six course treatment, as given in the description of the item, each layer of bonding materials, self finished bitumen felt or stone grit or pea sized gravel being counted as a course.

15.4.5.2 The choice of a four or six course treatment will depend on the climatic condition, the importance of the building, the durability required, cost and other relevant considerations.

15.4.5.3 In a six course treatment, the first, second and third layer shall be of the same as in the four course treatment. The fourth and fifth layer shall consist of self finished felt and bonding material respectively. The sixth layer shall consist of stone grit or pea sized gravel.

15.5.6 Laying

15.5.6.1 Bitumen bonding material of required grade shall be heated to the working temperature specified for the particular grade by the bitumen manufacturers and conveyed to the roof in buckets or pouring canes in weighed quantities. Suitable working temperature for different grades of bitumen are as under:

(i) Blown type petroleum bitumen of IS grade 85/25 or 90/15 - 180 degree C.

(ii) Residual type petroleum bitumen of penetration 30/40 - 180 degree to 190 degree C (IS grade S-35).

15.5.6.2 The felt shall not be laid in single piece of very long lengths as they are likely to shrink; 6 to 8 m are suitable lengths. The roof surface shall be cleaned and dried before the felt treatment is begun. Each length of felt shall be laid in position and rolled up for a distance of half its length. The hot bonding material shall be poured on the roof across the full width of the rolled felt as the latter is steadily rolled out and pressed down. The pouring shall be so regulated that the correct weight of bonding material per unit area is spread uniformly over the surface. Excess bonding material that gets squeezed out at the ends shall be levelled up as laying proceeds. When the first half of the strip of felt has been bonded to the roof, the other half shall be rolled up and then unrolled on the hot bonding material in the same way. Subsequent strips shall also be laid in the same manner. Each strip shall overlap the preceeding one by at least 7.5 cm at the longitudinal edges and 10 cm at the ends. All overlaps shall be firmly bonded with hot bitumen The third layer of bonding material in the four course treatment shall be carried out in a similar manner after the flashing has been completed.

15.5.6.3 High Parapet Walls, Chimney Stacks etc.: Felts shall be laid as flashings wherever junctions of vertical and horizontal surfaces occur. Longitudinal laps shall be 10 cm. The lower layer of flashing felt in a six course treatment shall overlap the roof water proofing by not less than 20 cm while the upper layer shall overlap the roofing felt by 10 cm. The minimum overlap of the flashing felt in four course specification over the roofing felt shall be 10 cm.

15.5.6.4 Low Parapet Walls: Where parapet walls are of height 45 cm or less, bitumen felt flashings shall be provided in the same manner as for flashings in the case of high parapet walls except that the upper edge shall be carried upto the full height of the wall and taken right across the top of the parapet and down on the external vertical faces to a minimum distance of 5 cm.

15.5.6.5 Low Dividing Walls: W here low dividing walls or inverted beams are met with, the same shall be covered with a four or six layer treatment as for the main roof, the latter bearing carried down both sides of the wall and overlapping the roofing treatment as in the case of flashing of high parapet walls.

15.5.6.6 Expansion Joints: Where the expansion joints are provided in the slabs, the joints and their cover slabs shall be suitably treated with water proofing. The cover slabs shall cover the vertical turned up dwarf walls by not less than 7.5 cm and are

provided with throatings on their underside along their length. The water proofing treatment shall be taken up the sloping junction fillets and the vertical faces of the walls to the underside of the cover slabs. The cover slabs are given the water proofing treatment like the roof slabs, after the cross joints between adjacent cover slabs are first sealed with 15 cm width of roofing felt struck to them with bitumen. The water proofing treatment shall be carried down the sides of the cover slabs to their full thickness. Care shall be taken to see that overlaps if any in the roofing over the cover slabs stagger with the joints between cover slabs.

15.5.6.7 **Pipes:** Where vertical pipe outlets are met with 7.5 x 7.5 cm fillets of lime or cement concrete shall be provided and flashing of four or six course treatment, same as for the roofing treatment shall be laid.

The upper edge of the flashing shall be laid sloping down forward and butted against the pipe and annular depression so formed shall be filled with hot bitumen. A circular metal collar in the shape of an inverted truncated cone shall be fixed on the pipe to throw off the rain water clear of the flashing and this shall be paid for separately.

15.5.6.8 **Terrace:** Where roof surfaces are expected to be used precast cement concrete tiles or 40 mm thick cement concrete shall be laid on the water proofing treatment. In such cases, the final course of stone grit or pea sized gravel shall not be laid in the water proofing treatment. Suitable adjustment in the rates will be effected for not providing the stone grit or pea sized gravel layer. Cement concrete in situ flooring shall be laid in panel not exceeding 0.4 square metres each. Precast tiles or in situ concrete flooring where laid shall be paid for separately unless included in the description of the water proofing item.

15.5.7 Measurements

15.5.7.1 Length and breadth shall be measured correct to a cm. The area shall be calculated in square metres correct to two places of decimal.

15.5.7.2 Measurements shall be taken over the entire exposed area of roofing and flashing treatment including flashing over low parapet walls, low dividing walls and expansion joints and at pipe projections etc. Overlaps and tucking into flashing grooves shall not be measured.

15.5.7.3 Vertical and sloping surfaces of water proofing treatment shall also be measured under the four or six course treatment as the case may be, irrespective of the fact that the final course of grit or pea sized gravel is replaced by bitumen primer.

15.5.7.4 Primer or saturated felt underlay, where provided, shall also be measured in the same manner as the water proofing treatment and paid for separately. No deduction in measurements shall be made for either openings or recesses for chimney stacks, roof lights and the like, for areas upto 40 square decimetre (0.4 sqm) nor anything shall be paid for forming such openings.

For similar areas exceeding 40 sq. decimetre deductions will be made in measurements for full opening and nothing extra shall be paid for forming such openings.

15.6 GRADING ROOF WITH CEMENT CONCRETE 1:2:4

15.6.1 Materials

Cement, coarse sand and graded stone aggregate 20 mm nominal size, shall be used as specified in the item. The specifications for the materials and

method of preparation of concrete shall conform in general to the specification described in sub- head 4.0 of CPWD Specifications VOL-II,2009.

15.6.1.1 Laying:

Before laying cement concrete for grading, the level markings to the required slope/gradient shall be made only with cement concrete on the surface of the slab at suitable spacing with the help of string and steel tape (Measuring tape) so that the mason can lay the concrete to the required thickness, slope / gradient easily in between the two level markings. On getting the level marking approved by the Site Engineer the surface should be sprinkled with thick cement slurry and the concrete should be laid carefully, without throwing from height, in predetermined strips. The concrete should be consolidated by specially made wooden tamping. After the tamping is done the surface should be finished to required slope/gradient with wooden trowels without leaving any spots of loose aggregates etc. The mixed cement concrete must be laid in position, within half an hour of its mixing. In case any quantity of concrete remains unused for more than half an hour the same should be rejected and removed from the site.

15.6.1.2 Finishing:

The slope of finished terrace shall not be more than 1 in 120 unless a steeper slope is desired by the Engineer-in-Charge. The minimum thickness of the concrete at its junction with Khurra or parapets shall be 5 cm. The concrete shall be rounded at the junction of roof slab and parapet. It is desirable to provide a haunch/gola/filler at the junction of the parapet wall and the roof slab.

15.6.1.3 Thickness:

Average thickness shall be as per clause 22.9.1.2 as in CPWD specifications Vol-II,2009, chapter-22.

15.6.1.4 Curing:

Curing shall be done either by spreading straw/Hessian cloth over the graded surface, keeping the same wet for full 10 days or flooding the graded area with water by making kiaries with weak cement mortar, for 10 days. Occasional curing by simply spraying water now and then shall not be permitted under any circumstances.

15.6.1.5 Measurement: Length and breadth shall be measured correct to a cm. Area shall be worked out to nearest 0.01 sqm. and the cubical contents shall be worked out to nearest 0.001 cum.

15.7 GRADING ROOF WITH CEMENT MORTAR

15.7.1 Materials: Cement and coarse sand shall be as specified in the item of work or as described in sub-head 3.0 of CPW D Specifications,VOL-II,2009.

15.7.1.1 Cement Mortar: Cement mortar 1:3 (1 cement: 3 coarse sand) /1:4(1 cement: 4 coarse sand) specified in the item of work shall conform to the specification described in sub-head 3.0 of CPWD Specifications,VOL-II,2009.

15.7.1.2 Preparation of the Surface: The surface shall be cleaned properly with brooms bruch, cloth to remove all dirts, dust, mortar droppings.

15.7.1.3 Laying: Same as described in CPWD specifications Vol-II, chapter-22., except that cement mortar shall be tamped with wooden and steel trowels and surface finished with steel trowel.

15.7.2 Finishing

(i) The slope of finished surface shall not be more than 1 in 120 unless a steeper slope is specified in the item of work.

(ii) The finished surface of the grading shall present a smooth surface with correct slopes and uniform roundings wherever they are provided. The mortar surface shall be free of cracks. Excess trowelling shall be avoided.

15.7.1.5 Thickness: The minimum thickness of cement mortar grading at the junction with khurra or parapet wall shall be 20 mm. The cement mortar shall be rounded at the junction of roof slab and parapet. It is desirable to provide a haunch/gola/filler at the junction of parapet wall and the roof slab.

The maximum thickness that shall be adopted for grading with cement mortar shall be 50 mm. It is not at all desirable to lay the cement mortar grading for greater thickness and in that case it is advised to go in for grading with Cement Concrete.

15.7.3 Curing: Curing for the grading with cement mortar shall be done exactly as described before.

16.1 REPAIRS TO BUILDINGS

List of Codes to be followed for Repair and Maintenance Works are as below:

S. No.	Codes	Subject
1	IS 419	Specifications for Putty for use in Window Frames
2	IS 14900	Specifications for Transparent Float Glass

16.2 Specifications of Repairs to Buildings

16.2.1 REPAIRS TO PLASTER

16.2.2 The work includes cutting the patch and preparing the wall surface. Patches of 2.50 square metres and less in area shall be measured under item of 'Repairs to Plaster' under this sub-head. Plastering in patches over 2.5 square metres in area shall be paid for at the rate as applicable to new work under sub head 'Finishing'. general repair works given in CPWD specifications, chapter-14,Vol-II,2009.

16.2.3 The mortar of the patch, where the existing plaster has cracked, crumbled or sounds hollow when gently tapped on the surface, shall be removed. The patch shall be cut out to a square or rectangular shape at position marked on the wall as directed by the Engineer-in-Charge or his authorized representative. The edges shall be slightly under cut to provide a neat joint.

16.2.4 Preparation of Surface

The masonry joints which become exposed after removal of old plaster shall be raked out to minimum depth of 10 mm in the case of brick work and 20 mm in the case of stone work. The raking shall be carried out uniformly with a raking tool and not with a basuli, and loose mortar dusted off. The surface shall then be thoroughly washed with water, and kept wet till plastering is commenced.

16.2.5 Application of Plaster

Mortar of specified mix with the specified sand shall be used. The surface shall be finished even and flush and matching with the old surrounding plaster. All roundings necessary at junctions of walls, ceilings etc. shall be carried out in a tidy manner as in Chapter-14 of CPW D specifications, Vol-II,2009.

16.2.6 Finishing

After the plaster is thoroughly cured and dried the surface shall be white washed or colour washed to suit the existing finishing as required unless specified.

16.3 FIXING DOOR, WINDOW OR CLERESTORY WINDOW CHOWKHATS

16.3.1 In case of door frames without sills, holes 40 mm deep shall be made in the floor for fixing the lower end of verticals of the frames. For doors with sills, the sill plates shall be partly fixed in the floor so that they project above the floor to the height as directed by the Engineer-in-Charge.

16.3.2 Fixing & Finishing:

The sides of chowkhats of door, window or clerestory window abutting against or to be embedded in masonry shall be painted with two coats of coal tar before being placed in position. The chowkhats shall than be inserted in position with their hold-fasts bolted tight. The chowkhats shall than be adjusted to proper line and plumb and secured in position by temporary bracing which shall not be disturbed or removed until the hold fasts are embedded in the masonry and the concrete block has set. The concrete to be used for embedding hold-fasts shall be cement concrete 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).The minimum size of concrete block in which the hold-fasts will be embedded shall be 30 x 10 x 15 cm for 35 cm long holdfasts. The concrete of the block shall completely fill the hole made in the masonry for the purpose. The chase cut in the floor shall be cut square and construction joint shall be provided filled in with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) and rendered smooth at the top and finished to match the existing type of floor.

17.1 Dismantling and Demolishing

List of Codes to be followed for Dismantling and Demolishing Works are as below:

S. No.	Code	Subject
1	IS 1200 (Pt – XVIII)	Method of Measurements of Building and Civil Engineering Works (Part –XVIII) Demolition and Dismantling
2	IS 4130	Demolition of Buildings–Code of Safety

17.2 Specifications of Dismantling and Demolishing

17.2.1 Dismantling and Demolishing

Dismantling And Demolishing shall be done as per Chapter-15 of CPW D specifications VOL-II,2009.

17.2.2 Measurements

17.2.2.1 All work shall be measured net in the decimal system, as fixed in its place, subject to the following limits, unless otherwise stated hereinafter.

(a) Dimensions shall be measured correct to a cm.

(b) Areas shall be worked out in sqm correct to two places of decimal.

(c) Cubical contents shall be worked out to the nearest 0.01 cum.

17.2.2.2 Parts of work required to be dismantled and those required to be demolished shall be measured separately.

17.2.2.3 Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed.

17.2.2.4 Specifications for deduction for voids, openings etc. shall be on the same basis as that adopted for new construction of the work.

18.1 **Road Work:** List of Codes to be followed for Road Works are as below:

Sl.	IS Codes	Subject
1.	IS 73	Specification for paving bitumen
2.	IS 164	Ready mixed paint for road marking
3.	IS 217	Specification for cut back bitumen
4.	IS 8112	Specification for 43 grade ordinary Portland Cement
5.	IS 278	Specification for galvanized steel barbed wire for fencing
6.	IS 334	Glossary of terms relating to bitumen and tar

IRC STANDARDS:		
1.	IRC 10	Recommended practice for borrow pits for road embankments constructed by manual operation
2.	IRC 29	Specification for bituminous concrete for road pavements
3.	IRC 36	Recommended practice for construction of earth embankments for road works
4.	IRC 60	Tentative guidelines for the use of lime flyash concrete as pavement base of sub base
5.	IRC 88	Recommended practice for lime flyash stabilized soil base/ sub base in pavement construction
6.	IRC 107	Tentative specification for bitumen mastic wearing courses

18.2 **FENCING WITH G.I. BARBED WIRE AND RCC POSTS Materials**

18.2.1 R.C.C. posts and struts shall be as specified in 16.1.12 of CPWD specifications 2009 VOL-II. G.I. Barbed wire shall be as per IS 278.

18.2.2 **Spacing of Posts and Struts**

The spacing of posts shall be three metres centre to centre, unless otherwise specified, or as directed by the Engineer-in-Charge to suit the dimensions of the area to be fenced. Every 15th, last but one end post and corner posts shall be strutted on both sides and end posts on one side only.

18.2.3 **Fixing of Posts and Struts**

Pits 45 x 45 cm and 75 cm deep or as directed shall first be excavated true to line and level to receive the posts. In the case of struts, pits 70 x 45 x 75 cm deep or as directed shall be excavated to suit the inclination of the strut so that it is surrounded by concrete by not less than 15 cm at any point. The pits shall be filled with a layer of 15 cm thick cement concrete 1:3:6 (1 cement: 3 fine sand: 6 graded stone aggregate 40 nominal size). The posts and struts shall then be placed in the pits, the posts projecting 1.2 m or to the specified height above ground, true to line and position. The cement concrete 1:3:6 shall be filled in upto 15 cm for posts and 25 cm for struts below ground level at the base of the concrete so that the posts are embedded in the cement concrete block of size 45 x 45 x 60 cm and strut in block of size 70 x 45 x 50 cm. The concrete in foundations shall be watered for at least 7 days to ensure proper curing. The remaining portions of pits shall be filled up with excavated earth and the surplus earth disposed off as directed by the Engineer-in-Charge and site cleared.

18.2.4 Fixing G.I. Barbed Wire

The barbed wire shall be stretched and fixed in specified number of rows and two diagonals. Thebottom row shall be 14 cm above ground and the rest at 12.5 cm centre to centre. The diagonals shall be stretched between adjacent posts from top wire of one post to the bottom wire of the second post. The diagonal wires will be interwoven with horizontal wires by fixing the odd-rows of wires first , then the diagonal cross wires and lastly the even rows of wires. The barbed wire shall be held to the R.C.C. posts by means of G.I. staples fixed to wooden plugs or G.I. binding wire tied to 6 mm barnibs fixed while casting the posts. Turn buckles and straining bolts shall be used at the end posts, if so specified.

18.2.5 Measurements

Total length of G.I. barbed wire shall be measured in running meter correct to a cm.

18.3 G.I. BARBED WIRE FENCING WITH ANGLE IRON POSTS Materials

G.I. Barbed wire shall be as per IS 278 and angle iron shall be as per subhead – 10.00 steel work of CPWD Specification Vol. I- 2009. The angle shall be of size 40 × 40 × 6 mm.

18.3.1 Spacing of Posts and Struts

The spacing of posts shall be 3.00 m centre to centre, unless otherwise specified or as directed by the Engineer-in-Charge to suit the dimensions of the area to be fenced. Every 15th, last but one end posts and corner post shall be strutted on both sides and end post on one side only.

18.3.2 Fixing of Posts and Struts

This shall be as per 16.16.3. In addition, angle iron post at bottom shall be split and banded at right angle in opposite direction for 10 cm length to get proper grip.

18.3.3 Fixing G.I. Barbed Wire

The barbed wire shall be stretched and fixed in specified number of rows and two diagonals. The bottom row should be 14 cm above ground and the rest at spacing of 2.5 cm centre to centre. The diagonal shall be stretched between adjacent posts from the top wire of one post to the bottom wire of 2nd post. The diagonal wire will be inter woven with horizontal wires by fixing the odd rows of wires first, then the diagonal cross wires and lastly even rows of wires. The barbed wire shall be held by tearing the holes of 10 mm dia in the post and tied with G.I. wire, turn buckles and straining bolts shall be used at the end post, if so specified.

18.3.4 Measurements

Total length of G.I. barbed wire shall be measured in running meter correct to a cm.

18.4 RETRO REFLECTIVE SIGN BOARD

18.4.1 The colour, configuration, size and location of all the traffic signs for highways other than Expressways shall be in accordance with the code of practice for road signs, IRC:67 or as shown on the drawings. For expressways, the size of the signage, letters and their placement shall be as specified in the contract drawings and relevant specifications or as directed by the Engineer-in-Charge.

18.4.2 Retro-Reflective Sheeting (High Intensity Grade Sheeting of Encapsulated Lens Type):

The sheeting to be white or coloured having a smooth outer surface having the property of retro reflection over its entire surface shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of

cracking, scaling, pitting, blistering, edge lighters curling and shall have negligible shrinkage or expansions.

A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these tests shall be obtained from a reputed laboratory by the manufacture of the sheeting. This sheeting consists of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent, water proof plastic having a smooth surface. The retro-reflecting surface after cleaning with soap and water and in dry condition shall have minimum co-efficient of retro reflection (Conforming to ASTM standard E:810). When totally wet, the sheeting shall not show less than 90 per cent of the values of retro-reflection. At the end of 7 years, the sheeting shall return at least 75 per cent of its original retro-reflectance.

18.4.3 Adhesives :

The sheeting shall be tack free adhesive activated by heat, applied in a heat vacuum applicator, in a manner recommended by the sheeting manufacturer and approved by Engineer-in-Charge. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for sign. Adhesive shall form a durable bond to smooth corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument.

18.4.4 Installation

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. Complete sheet of the material shall be used on the signs except where it is unavoidable. Sheeting with heat activated adhesives may be spliced with an overlap not less than 5 mm or butted with a gap not exceeding 0.75 mm. The material shall cover the sign surf ace evenly and shall be free from twists, cracks and folds Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind load or displacement by vandalism. Normally, sign with an area upto 0.9 sq.m shall be mounted on a single post and for greater area two or more supports shall be provided. Sign supports shall be as specified in item or as per directions of Engineer-in-Charge. The work of foundation shall conform to relevant specification as specified. Backside of aluminium sheet portion shall be painted with two coats of epoxy paint. Any part and support frame with two or more coats of synthetic enamel paint.

18.4.5 Warranty and Durability

The Contractor shall obtain from the manufacturer a seven-year warranty for satisfactory performance including stipulated retro-reflectance of the retro-reflective sheeting and submit the same to the Engineer-in-Charge. Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and following cleaning, shall show no appreciable discolouration, cracking, blistering or dimensional change and shall not have less than 50 percent of the specified minimum reflective intensity values when

subjected to accelerated weathering of 1000 hours, using type E or EH Weatherometer (AASHTO Designation M 268).

18.4.6 Measurement

These shall be measured in square meters upto two place of decimal

18.5 RETRO REFLECTIVE OVERHEAD SIGNAGE

Overhead signs may be used in lieu of, or as an adjunct to, ground signs where the situation so warrants for proper information and guidance of the road user. The support system should be properly designed based on sound engineering principles, to safety sustain the dead load, live load and wind load on the completed sign system. For this purpose, the overhead signs shall be designed to withstand a wind loading of 150 kg/m2 normal to the face of the sign and 30 kg/m2 transverse to the face of the sign. In addition to the dead load of the structure, walkway loading of 250kg concentrated live load shall also be considered for the design of the overhead sign structure.

18.5.1 Height

Overhead signs shall provide a vertical clearance of not less than 5.5 m over the entire width of the pavement and shoulders except where a lesser vertical clearance is used for the design of other structures. The vertical clearance to overhead sign structures or supports need not to be greater than 300 mm in excess of the minimum design clearance of other structures.

18.5.2 Lateral Clearance

The minimum clearance outside the usable roadway shoulder for expressway sign mounted at the road side or for overhead sign supports either to the right or left side of the roadways shall be 1.80 m. This minimum clearance of 1.80 m shall also apply outside of an unmountable kerb. Where practicable, a sign should not be less than 3 m from the edge of the nearest traffic lane. Where a median is 3.6 m or less in width, consideration should be given to spanning over both roadways without a central support. Where overhead sign supports cannot be placed at a safe distance away from the line of traffic or in an otherwise protected site, they should either be so designed as to minimise the impact forces or protect motorists adequately by a physical barrier or guard rail of suitable design.

18.5.3 Number of Signs at an Overhead Installation

In no case should there be more than three signs displayed at any one location, including regulatory or warning signs, either on the overhead structure or on its support.

18.5.4 Materials for Overhead Sign and Support Structures

Aluminium alloy or galvanized steel to be used as truss design supports shall conform to relevant IS. These shall be of sections and type as per structural design requirements as shown on the plans Plates and support sections for sign posts shall conform to IS 226 and IS 2062 .The overhead signs shall be reflectorised with high intensity retro-reflective sheeting of encapsulated lens type.

18.5.5 Size, Locations, etc of Signs

The size of the signs, letter and their placement shall be as specified in the Contract drawings and specifications as per direction of Engineer-in-Charge

18.5.6 Installation

The supporting structure and signs shall be fabricated and erected as per details given in the plans. Sign posts, their foundations and sign mountings shall be so constructed as to hold sign in a proper and permanent position to adequately resist swaying in the wind or displacement by vandalism. The work of construction of foundation for sign supports including excavation and backfill, forms, steel reinforcement, concrete and its placement shall conform to the relevant specifications given in this specification. The structures shall be erected with the specified camber and in such a manner as to prevent excessive stresses, injury and defacement. Brackets shall be provided for mounting signs of the type to be supported by the structure. For better visibility, they shall be adjustable to permit mounting the sign faces at any angle between a truly vertical position and three degree from vertical. This angle shall be obtained by rotating the front lower edge of the sign forward. All brackets shall be of a length equal to the heights of the signs being supported. Before erecting support structures, the bottom of each base plate shall be protected with an approved material which will adequately prevent any harmful reaction between the plate and the concrete. The end supports shall be plumbed by the use of levelling nuts and the space between the foundation and base plate shall be completely filled with an anti-shrink grout. Anchor bolts for sign supports shall be set to proper locations and elevation with templates and carefully checked after construction of the sign foundation and before the concrete has set. All nuts on aluminium trusses, except those used on the flanges, shall be tightened only until they are snug. This includes the nuts on the anchor bolts. A thread lubricant shall be used with each aluminium nut. All nuts on galvanized steel trusses, with the exception of high strength bolt connections, shall be tightened only to a snug condition. Field welding shall not be permitted. After installation of signs is completed, the sign shall be inspected by the Engineer. If specular reflection is apparent on any sign, its positioning shall be adjusted by the Contractor to eliminate or minimize this condition.

18.5.7 Measurement

These shall be measured in sqmeter upto two place of decimal.

18.6 KERB STONE (PRECAST)

18.6.1 Laying:

Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete of specified grade. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar of specified proportion. The kerb stones with top 20 cm. wide shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 10 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement : 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days.The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

18.6.2 Finishing

Berms and road edges shall be restored and all surplus earth including rubbish etc. disposed off as directed by the Engineer-in-charge. Nothing extra shall be paid for this.

18.6.3 Measurements It shall be measured in cubic meters with Length of the finished work (for specified width and height of stone) shall be measured in running metre along the edge of the road correct to a cm.

19.1 Sanitary Installation Work:

List of Codes to be followed for Sanitary Installation Works are as below:

S. No.	IS No.	Subject
1.	IS 771 (Pt.1)	Specification for glazed fire clay sanitary appliances: Part 1: General requirements.
2.	IS 771 (Pt.-2)	Specification for glazed fire clay sanitary appliances: Part 2: Specific requirements of kitchen and laboratory sink.
3.	IS 772	Specific action for general requirements for enameled cast iron sanitary appliances.
4.	IS 774	Flushing cisterns for water closets and urinals (Other than plastic cistern)-Specifications.
5.	IS 1703	Water fittings- copper alloy float valves (horizontal plunger type) - Specification.
6.	IS 1729	Cast iron /Ductile Iron Drainage Pipes and pipe fittings for Over ground non-pressure pipe line Socket and Spigot Series.
7.	IS 2326	Specification for Automatic Flushing Cisterns for Urinals (Other than plastic cisterns)
8.	IS 2548 (Part-1)	Plastic seats and covers for water closets Part 1: Thermo set seats and covers - Specifications
9.	IS 2548 (Part-2)	Plastic seats and covers for water closets Part 2: Thermoplastic seats and covers.- Specifications
10.	IS 2556	Vitreous sanitary appliances (vitreous china) - Specifications
11.	IS 2556 (Part-1)	Part-1: General requirements.
12.	IS 2556 (Part-2)	Part-2: Specific requirements of wash-down water closets.
13.	IS 2556 (Part-3)	Part-3: Specific squatting pans.
14.	IS 2556 (Part-4)	Part-4: Specific requirements of wash basins.
15.	IS 2556 (Part-5)	Part-5: Specific requirements of laboratory sinks.
16.	IS 2556 (Part-6)	Part-6: Specific requirements of Urinals & Partition plates
17.	IS 2556 (Part-7)	Part-7: Specific requirements of accessories for sanitary appliances
18.	IS 2556 (Part -14)	Part-14: Specific requirements of integrated squatting pans.
19.	IS 2556 (Part -15)	Part-15: Specific requirements of universal water closets.
20.	IS 3076	Specification for low density polyethylene pipes for potable water supplies.
21.	IS 4984	Specification for high density polyethylene pipes for
22.	IS 4985	Unplasticised P.V.C. pipes for potable water supply – Specifications.

23.	IS 7231	Plastic flushing cisterns for water closets and urinals – Specifications.
24.	IS 13983	Stainless steel sinks for domestic purposes – Specifications.

19.2 APPLIANCES AND FITTINGS

19.2.1 All vitreous sanitary appliances (Vitreous China) shall conform to IS 2556 (Part-I) general requirements.

19.2.2 Flushing Cisterns:

The flushing cisterns shall be automatic or manually operated high level or low level as specified, for water closets and urinals. A high level cistern is intended to operate with minimum height of 125 cm and a low level cistern with a maximum height of 30 cm between the top of the pan and the under side of the cistern. Cisterns shall be of following type (i) Vitreous China (IS 774) for Flushing type (ii) Automatic Flushing Cistern (IS 2326) and (iii) Plastic cisterns (IS 7231).

19.2.2.1 Vitreous Chine Cisterns

The thickness of the body including cover shall be not less than 6 mm for v itreous China cisterns. The outlet of each syphon or stand pipe shall be securely connected to the cisternby means of lock nut. The cistern shall be free from manufacturing faults and other defects affecting their utility. All working parts shall be designed to operate smoothly and efficiently. Cistern shall be mosquito proof. A cistern shall be considered mosquito proof only if there is no clearance anywhere which would permit a 1.6 mm wire to pass through in the permanent position of the cistern i.e. in the flushing position or filling position. The breadth of a low level cistern, from front to back shall be such that the cover or seat, or both, of water closet pan shall come to rest in a stable position when raised. The cistern shall be supported on two cast iron brackets of size as approved by the Engineer-in- Charge and embedded in cement concrete 1:2:4 block 100 x 75 x 150 mm. These shall be properly protected by suitable impervious paint. Alternatively the cisterns shall have two holes in the back side above the overflow level for screwing into the wall, supplemented by two cast iron wall supports. A 5 litres cistern, however, may be supported by larger brackets cast on the body of the cistern. The cistern shall have a removable cover which shall fit closely on it and be secured against displacement. In designs where the operating mechanism is attached to the cover this may be made in two sections, but the section supporting the mechanism shall be securely bolted or screwed to the body. The outlet fitting of each cistern shall be securely connected to the cistern. The nominal internal diameter of cistern outlet shall be not less than 38 ± 1mm for low level cisterns respectively. The length of the outlet of the cistern shall be 37 ± 2 mm.Ball valve shall be of screwed type 15 mm in diameter and shall conform to IS 1703. The float shall be made of polyethylene as specified in IS 9762. (The design shall permit the cistern to fill in rapidly and close effectively when the level of water reaches the working water level.) In the case of manually operated cisterns the siphonic action of the flushing cistern shall be capable of being rapidly brought into action by the operating lever, but shall not self siphon or leak. When tested according to IS 774 the discharge rate shall be 10 ± 0.5 litre in 6 seconds and 5 ± 0.5 litre in 3 seconds for cisterns of capacities 10 litre and 5 litre respectively. The cisterns shall be so

designed that there is not appreciable variation in the force of flush during the discharge of the required quantity of water. The cistern shall have a discharge capacity of 5 & 10 litres as specified. W hen required to give a full flush, they shall respectively discharge 5 litres and 10 litres with variation of ± 0.5 litres.The flush pipe shall be of (a) medium quality galvanised iron having internal diameter of 38 ± 1 mm for low level cistern. The flush pipe shall be of suitable length with bends etc. as required for fixing it with front or back inlet W.C. Pan. (b) Polyethylene pipes low density conforming to IS 3076 or high density (c) Unplasticised PVC pipes. For high density polyethylene and unplasticised PVC pipes, the outside diameter of the pipes shall be 40 mm. When PVC plumbing pipes are used the outside diameter of the pipe shall be 40 mm for high level cisterns and 50 mm for low level cisterns. In case of low level cistern the flush pipe shall be a vertical pipe 30 cm long and having a nominal internal dia 38 ± 1 mm (except plastic flush pipes).

19.2.2.1.1 Over Flow Pipe

(a) GI overflow pipe shall be of not less than 20 mm nominal bore and shall incorporate a non- corrodible mosquito proof brass cover having 1.25 mm dia perforation, screwed in a manner which will permit it to be readily cleaned or renewed when necessary. No provision shall be made whereby the overflow from the cistern shall discharge directly into the water closet or soil pipe without being detected.The invert of the overflow pipe in the case of high level and low level cisterns shall be 19 mm minimum above the working water level. In case of overflow due to any reason water should drain out through the over flow pipe and not through the siphon pipe. (b) The plastic overflow pipes shall be manufactured from high density polyethylene conforming to IS 4984 or unplasticised P.V.C. conforming to IS 4985.

19.2.2.1.2 Inlet and Overflow Holes:

The cistern shall be provided with inlet and overflow holes, situated one at each end which shall be capable of accommodating an overflow pipe of not less than 20 mm nominal bore and a 15 mm size ball valve. The holes shall be cleanly cast or drilled and the adjacent surfaces shall be smooth.

19.2.2.2 PVC Cisterns: Plastic flushing cisterns for W C and Urinals shall be as per IS7231.The materials for manufacturing various components of the flushing cisterns shall conform to the requirements given in Table 19.1 below:

TABLE 19.1 Materials for Various Components of Flushing Cisterns

S. No.	Component(s)	Material	Conforming to
(1)	(2)	(3)	(4)
1.	Cisterns	High density polyethylene (HDPE) Or Polystryene, high impact Or Polypropylene Or Acrylonitrile-butadiene-styrene (ABS) Or Glass Fibre reinforced plastic (GRP)	IS 7328 IS 2267 -

2.	Flush pipe	Steel tube, seamless or welded, medium or light, completely protected inside and outside by hot-dip galvanizing, electroplating or vitreous enamelling Or Lead pipe Or Copper alloy tube Or High density polyethylene pipe Or Unplasticised PVC plumbing pipe	IS 1239 ((Part 1) IS 404 (Part 1) IS 407 IS 2501
3.	Cover	Same material as that of the body	
4.	Chain	Hot-dip galvanized steel wires Or Inter-locked non-ferrous metal Or Any other corrosion resistant material	-
5.	Overflow pipe	High density polyethylene Or Unplasticised PVC Or Any other corrosion-resistant material	IS 4984 IS 4985
6.	Siphon/ Valve	High density polyethylene Or Polystyrene, high impact Or Polypropylene Or Acrylonitrile- butadiene-styrene Or Glass fibre reinforced plastic (GRP)	IS 7328 IS 2267 -
7.	Operating Mechanism/	Non-ferrous metal or any other corrosion-resistant material	-
8.	Float valve	As specified in IS 1703 Or IS 12234 Or IS 13049	
9.	Polyethylene float for float valve	As specified in IS 9762	-
10.	Coupling nut and lock-nut	Non-ferrous metal, Or Hot-dip galvanised steel Or Hot-dip galvanised malleable iron Or Any other non-corrosive metal Or Injection-moulded HDPE/polyacetal	

1)Talc as filler, if used shall not exceed 20% The thickness of the body including cover at any point shall not be less than 2 mm for GRP, and not less than 3 mm

for other plastic materials. The cistern shall be free from manufacturing faults and other defects affecting its utility. All working parts shall be designed so as to operate smoothly and efficiently. The cistern shall be mosquito-proof. It shall be deemed to be mosquito proof only when there is no clearance anywhere in it which would permit a 1.6 mm diameter wire to pass through. The outlet of each siphon or stand pipe or flush valve shall be securely connected to the cistern by means of a lock nut. In the case of plastic siphon, it shall be provided with suitable means of ensuring and maintaining watertight and airtight joint to the cistern. The cistern shall be provided with a removable cover which shall fit closely and shall be secured against displacement. In designs, where the operating mechanism is attached to the cover, the cover may be made in two sections, the section supporting the mechanism being securely fixed or booked to the body. The flush pipe (except plastic flush pipe) shall have an internal diameter of 32 + 1 mm for high level cistern and 38 + 1 mm for low level cistern. The steel flush pipe shall be not less than 1 mm thick whereas the lead flush pipe shall have a minimum thickness of 3.5 mm. For high density polyethylene pipes the outside diameter of the pipes shall be 40 mm. For unplasticised PVC plumbing pipes the outside diameter of the pipe shall be 40 mm for high level cisterns, and 50 mm for low level cisterns. In the case of high level flushing cisterns, a pipe clip fitted with a rubber buffer shall be fixed to the flush pipe to prevent damage either to the pipe or to the seat when the seat is raised. No flush pipe is required for coupled cisterns.

19.2.3 Draining Board

Draining board made of Glazed fireclay conforming to C.P.W.D. Specifications and as per directions of Engineer-in-Charge, shall be provided. The size of the board shall be as specified. The entire surface including bottom of the board shall be finished smooth.

19.2.4 Foot Rests

Foot rests shall be of Vitreous China conforming to IS 2556 (Part-X). Foot rests which are rectangular shall meet the minimum requirements and may be of different designs where so specified. Foot rests of different shapes and sizes shall also be allowed subject to approval of Engineer-in-Charge.

19.2.5 Glass Shelf/PVC Shelf

Glass shelf shall consist of an assembly of glass shelf, with anodised aluminium angle frame to support the glass shelf. The shelf shall be of glass of best quality with edges rounded off, and shall be free from flaws specks or bubbles. The size of the shelf shall be 60 x 12 cm unless otherwise specified and thickness not less than 5.5 mm. The shelf shall have C.P. brass brackets which shall be fixed with C.P. brass screws to rawl plugs firmly embedded in the walls. PVC shelf as per manufacturer‘s specifications and size as specified shall be provided.

19.2.6 Mirror

The mirror shall be of superior glass with edges rounded off or beveled, as specified. It shall be free from flaws, specks or bubbles. The size of the mirror shall be 60 x 45 cm unless specified otherwise and its thickness shall not be less than 5.5 mm. It shall be uniformly silver plated at the back and shall be free from silvering defects. Silvering shall have a protective uniform covering of red lead paint. Where beveled edge mirrors of 5.5 mm thickness are not available, fancy looking mirrors with PVC beading/border or aluminium beading or

stainless steel beading/border based on manufacture's specifications be provided nothing extra shall be paid on this account. Backing of mirrors shall be provided with environmentally friendly material other than asbestos cement sheet.

19.2.7 M.S. Stays and Clamps

The clamps shall be made from 1.5 mm thick M.S. flat of 32 mm width, bent to the required shape and size to fit tightly on the socket, when tightened with nuts & bolts. It shall be formed of two semicircular pieces with flanged ends on both sides with holes to fit in the screws, bolts and nuts 40 mm long. The stay shall be minimum one metre long of 10 mm dia M.S. bar. One end of the stay shall be bent for embedding in the wall in cement concrete block of size 20 x 10 x 10 cm in 1:2:4 mix (1 cement :2 coarse sand : 4 graded stone aggregate 20 mm nominal size). The concrete shall be finished to match with the surrounding surface.

19.2.8 Pillar Taps

Pillar taps shall be chromium plated brass and shall conform to IS 1795. The nominal sizes of the pillar tap shall be 15 mm or 20 mm as specified. The nominal size shall be designated by the nominal bore of the pipe outlet to which the tap is to be fitted. Finished weights of 15 mm and 20 mm pillar taps shall be as prescribed in Table 19.2.

Table19.2 Minimum Finished Weight of Pillar Taps

Particulars	**Weights in gms**	
	15 mm size	**20 mm size**
Body	255	505
Washer plate loose valve	15	28
Back nut	40	50
Tap	650	117

Every pillar tap, complete with its component parts shall withstand an internally applied hydraulic pressure of 20 Kg/sq. cm maintained for a period of 2 minutes during which period it shall neither leak nor sweat.

19.2.9 Plastic Seat and Covers for Water Closet

The seat and cover shall be of thermosetting or thermoplastic conforming to IS 2548 as specified. Unless otherwise specified these shall be of closed pattern.

19.2.9.1 Thermosetting plastic used shall conform to grade 2 or 3 of IS 1300 when it is phenolic plastic or IS 3389 when of urea formaldehyde. Thermo plastic materials used may be of Polystyrene conforming to type 2 or 3 of IS 2267 or of polypropylene, Appendix A of IS 2548. In public buildings where rough and heavy use of seats and covers are common, plastic seats shall be moulded out of thermosetting materials, phenolic or urea formaldehyde only and the underside of the seat shall be flat with solid moulding.

19.2.9.2 The hinging device shall be bronze or brass with nickel chromium plating confirming to IS 1068 and the seat shall have not less than three rubber or plastic buffers of size 25 mm x 40 mm x 10 mm for closed front seats and not less than four for open front seats, which shall be securely fixed to the underside of the seat unless otherwise specified. The cover shall be fitted with the same number of buffers as provided for the seat.

19.2.9.3 Seats shall have a smooth finish and shall be non absorptive and free from cracks and crevices. They shall be capable of being easily cleaned and shall not be adversely affected by common solvents or household cleanser.

19.2.9. Strength: The seats shall withstand without permanent distortion of the seat or hinge fittings or damage to any finish, a load of 1150 N for 30 minutes applied in the manner prescribed in IS 2548.

19.2.10 Sinks Laboratory sinks and Kitchen sinks shall be of white glazed fire clay confirming to IS 771 (Part-2) with up to date amendments. The kitchen sink shall be of one piece construction with or without rim but without overflow.

19.2.10.1 Stainless steel kitchen sink shall be of sizes as specified and shall be conforming to IS 13983.

19.2.11 Towel Rail: The towel rail shall be of PTMT as specified and as per direction of Engineer-in-charge.

19.2.12 Toilet Paper Holder

The toilet paper holder shall be of CP brass or vitreous china as specified and of size and design as approved by the Engineer-in-Charge. It shall be fixed in position by means of C.P. brass screws and rawl plugs embedded in the wall.

19.2.13 Urinals

19.2.13.1 Bowl Type Urinals: Urinal basins shall be of flat back or corner wall type lipped in front. These shall be of white vitreous china conforming to IS 2556-(Part 6). The urinals shall of one piece construction. Each urinal shall be provided with not less than two fixing holes of minimum dia 6.5 mm on each side. Each urinal shall have an integral flushing rim of suitable type and inlet or supply horn for connecting the flush pipe. The flushing rim and inlet shall be of the self draining type. It shall have a weep hole at the flushing inlet of the urinals.

19.2.13.2 Half Stall Urinals: They shall be of white vitreous China conforming to IS 2556 (Part 6). They shall be of one piece construction with or without an integral flushing box rim and provided with slots or alternative fixing arrangement at the flat back end. They shall be provided with ridges where integral flushing rim is not provided in the sides of the interior of the bowl, to divert the water towards the front line of the urinal where integral flushing box rim is specified, water spreaders provided sha ll conform to IS 2556 Part-6. These shall be vitreous China of one piece construction with integral flush inlet. The tolerance of ± 4 per cent may be allowed on the dimensions specified.

19.2.13.3 Urinal Partition Slabs : Urinal Partition slabs shall be provided, as specified in the item of work.

19.2.13.4 Squatting Plate Urinal: The plates shall be of white vitreous china conforming to IS 2556 (Part-1) and IS 2556 (Part-6) with internal flushing rim with front or side inlet. Squatting Plate shall be of one piece construction. Each urinal shall have integral longitudinal flushing pipe of suitable type which may be connected to flush pipe. These shall be 100 mm dia white glazed vitreous china channel with stop and outlet piece in front.

19.2.14 Wash Basins:

Wash basins shall be of white vitreous china conforming to IS 2556 (Part-I) and IS 2556 (Part-4). All internal angles shall be designed so as to facilitate cleaning. Each basin shall have a rim on all sides, except sides in contact with the walls and shall have a skirting at the back. Basins shall be provided with single or double tap holes as specified. The tap holes shall be 28 mm square or 30 mm

round or 25 mm round for pop up hole. A suitable tap hole button shall be supplied if one tap hole is not required in installation. Each basin shall have circular waste hole to which the interior of basin shall drain. The waste hole shall be either rebated or beveled internally with dia meter of 65 mm at top. Each basin shall be provided with a non-ferrous 32 mm waste fitting. Stud slots to receive the brackets on the underside of the wash basin shall be suitable for a bracket with stud not exceeding 13 mm diameter, 5 mm high and 305 mm from the back of basin to the centre of the stud. The stud slots shall be of depth sufficient to take 5 mm stud. Every basin shall have an integral soap holder recess or recesses, which shall fully drain into the bowl. A slot type of overflow having an area of not less than 5 sq. cm, shall be provided and shall be so designed as to facilitate cleaning of the overflow. Where oval shape or round shape wash basins are required to be fixed these shall be fixed preferably in RCC platform with local available stone topping either fully sunk in stone top or top flush with the stone topping as directed by Engineer-in-Charge. The wash basins shall be one of the following patterns and sizes as specified:

(a) Flat back: 660 x 460 mm (Surgeon‘s Basin)
630 × 450 mm
550 × 400 mm
450 × 300 mm

(b) Angle back: 600 × 480 mm
400 × 400 mm

19.2.15 Waste Fittings for Wash Basins and Sinks: The waste fittings shall be of nickel chromium plated brass, with thickness of plating not less than service grade 2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall be sound, free from laps, blow holes and fittings and other manufacturing defects. W aste fitting for wash basins shall be of nominal size of 32 mm. Waste fittings for sinks shall be of nominal size 50 mm.

19.2.16 Water Closet

19.2.16.1 Squatting Pans (Indian Type W.C): Squatting pans shall be of white vitreous china conforming to IS 2556 Part-I for General Requirements and relevant IS codes for each pattern as described below:

(1) Long pattern-conforming to IS 2556 (Part-3).
(2) Orissa pattern-conforming to IS 2556 (Part-3).
(3) Integrated type conforming to IS 2556 (Part-14).

Preferably Orissa type pan should be used. Each pan shall have an integral flushing rim of suitable type. It shall also have an inlet or supply horn for connecting the flush pipes. The flushing rim and inlet shall be of the self draining type. It shall have weep hole at the flushing inlet to the pan. The flushing inlet shall be in the front, unless otherwise specified or ordered by the Engineer-in-Charge. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and the surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have grooves at right angles to the axis of the outlet. In all cases a pan shall be provided with a (100 mm) S.C.I. trap ‗P‘ or ‗S‘ type with approximately 50 mm water seal and 50 mm dia vent horn, where required by the Engineer-in-Charge.

19 .3 GENERAL REQUIREMENTS FOR INSTALLATION OF W.C. PAN

19.3.1 The work shall be carried cut, complying in all respects with the requirements of relevant bye-laws of the local body in whose jurisdiction the work is situated.

19.3.2 Any damage caused to the building, or to electric, sanitary, water supply or other, installations etc. therein, either due to negligence on the part of the contractor, or due to actual requirements of the work, shall be made good and the building or the installation shall be restored to its original condition by the contractor. Nothing extra shall be paid for such restoration works except where otherwise specified.

19.3.3 For making good the damage to the under mentioned items of work, the specifications as given in the following paras shall apply, unless directed otherwise.

(a) Masonry Work: The masonry work shall be made good by using the same class of bricks, tiles or stones as was damaged during the execution of the work. The mortar used shall be cement mortar 1:5 (1 cement: 5 fine sand) or as directed by the Engineer-in-Charge.

(b) Plain Concrete Work: Concrete work for sub-grade of the flooring, foundations and other plain concrete works shall be cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size). A coat of neat cement slurry shall be applied at the junction with old work, before laying fresh concrete.

(c) Cement Concrete Flooring and R.C.C. Work: Cement concrete 1:2:4 (1Cement : 2 Coarse sand : 4 graded stone aggregate 20 mm nominal size) shall be used after applying a coat of neat cement slurry at the junction with old work, and the surface finished to match with the surrounding surface.

(d) Plastering: Cement plaster 1:4 (1 cement: 4 sand) shall be used. The sand shall be fine or coarse, as used in the original work. The surface shall be finished with two or more coats of white wash, colour wash, distemper or painting as required, but where the surface is not to be white washed, colour washed, distempered or painted, it shall be finished as required to match with the surrounding surface.

19.3.4 All exposed G.I., C.I. or lead pipes and fittings shall be painted with approved quality of paint and shade as specified. The painting work shall conform to specification described under SH: Painting.

19.3.5 All sanitary and plumbing work shall be carried out through licensed plumbers.

19.3.6 Various sanitary fittings described or in combination under relevant items of works as described below.

19.4 INSTALLATION OF DRAINING BOARD

19.4.1 **Fixing:** One end of the board shall rest on sink and the other end shall be supported on C.I. bracket embedded in cement concrete (1:2:4) block 100 × 75 × 150 mm. The brackets used shall be of cantilever type or wall fixed type as for the sink.

19.4.2 **Painting:** The brackets shall be painted with two or more coats of approved paint.

19.5 INSTALLATIONS OF FLUSHING CISTERN

19.5.1 Fixing:

19.5.1.1 **Low Level Cistern:** The cistern shall be fixed on C.I. cantilever brackets which shall be firmly embedded in the wall in cement concrete (1:2:4) block 100 x 75 x

150 mm. Connection between c istern and closet shall be made by means of 40 mm dia flush bend with rubber or G.I. inlet connection as specified.

19.5.1.2 **Automatic Cistern:** Clause 17.4.1.1 in CPW D specif icat ions VO L-II, 2009, shall apply except that CP Brass stop cock shall be provided for cistern having a capacity of more than 5 liter. The main & distribution flush pipe shall be fixed to the wall by means of standard pattern holder bat clamp.

19.5.2 **Painting:** The brackets shall be painted, if specified, with two or more coats of paint of approved shade and quality.

19.6 INSTALLATION OF MIRROR

19.6.1 **Fixing:** The mirror shall be mounted on backing with environmentally friendly material other than asbestos cement sheet shall be fixed in position by means of 4 C.P. brass screws and C.P. brass washers, over rubber washers and wooden plugs firmly embedded in walls. C.P. brass clamps with C.P. brass screws may be an alternative method of fixing, where so directed. Unless specified otherwise the longer side shall be fixed horizontally.

19.7 FIXING AND JOINTING OF PIPES AND FITTINGS

19.7.1 The specifications described in sub-head 12.0 of CPWD specifications Vol-II, shall apply, as far as applicable, except that the joint shall be lead caulked. All soil pipes shall be carried up above the roof and shall have sand cast iron terminal guard.

19.8 INSTALLATION OF SEAT AND COVER TO WATER CLOSET

19.8.1 **Fixing:** The seat shall be fixed to the pan by means of two corrosion resistant hinge bolts with a minimum length of shank of 65 mm and threaded to within 25 mm of the flange supplied by the manufacturer along with the seat. Each bolt shall be provided with two suitably shaped washers of rubber or other similar materials for adjusting the level of the seat while fixing it to the pans. In addition, one non-ferrous or stainless steel washer shall be provided with each bolt. The maximum external diameter of the washer fixed on the underside of the pan shall not be greater than 25 mm. Alternative hinging devices as supplied by the manufacturer of the seat can also be used for fixing with the approval of Engineer-in- Charge.

19.9 INSTALLATION OF SINK

19.9.1 The installation shall consist of assembly of sink C.I. brackets, union and G.I. or P.V.C. waste pipe.

19.9.1.1 **Fixing:** The sink shall be supported on C.I. cantilever brackets, embedded in cement concrete (1:2:4) block of size 100 x 75 x 150 mm. Brackets shall be fixed in position before the dado work is done. The C.P. brass or P.V.C. union shall be connected to 40 mm nominal bore G.I. or PVC waste pipe which shall be suitably bent towards the wall and shall discharge into a floor trap. C.P. brass trap and union and waste shall be paid separately. The height of front edge of sink from the floor level shall be 80 cm.

19.10 INSTALLATION OF URINAL LIPPED, HALF STALL (SINGLE OR RANGE):

19.10.1 Urinal installation shall consist of a lipped urinal (Single or range), an automatic flushing cistern, G.I. flush and waste pipe. The capacity of flushing cistern and relevant size of flush pipe for urinals in a range shall be as prescribed in Table 19.3. Waste pipe shall be of 32 mm nominal bore G.I. pipe and shall be paid separately.

19.10.2 **Fixing:** Urinals shall be fixed in position by using wooden plugs and screws. It shall be at a height of 65 cm from the standing level to the top of the lip of the urinal, unless otherwise directed by the Engineer-in-Charge. The size of wooden plugs shall be 50 mm × 50 mm at base tapering to 38 mm × 38 mm at top and of length 5.0 cms. These shall be fixed in the wall in cement mortar 1:3 (1cement: 3 fine sand). After the plug fixed in the wall, the mortar shall be cured till it is set.

TABLE 19.3

No. of Urinals in Range	Capacity of Flushing Cistern	Size of Flush Pipe (Galvanized)	
One Two Three Four		Main	Distribution
	5 Litres	15 mm	15 mm
	10 Litres	20 mm	15 mm
	10 Litres	25 mm	15 mm
	15 Litres	25 mm	15 mm

Each urinal shall be connected to 32 mm dia waste pipe which shall discharge into the channel or a floor trap. The connection between the urinal and flush or waste pipe shall be made by means of putty or white lead mixed with chopped hemp.

19.11 INSTALLATION OF WASH BASIN:

19.11.1 The installation shall consist of an assembly of wash basin, pillar taps, C.I. brackets, C.P. brass or P.V.C. union, as specified. The wash basin shall be provided with one or two 15 mm C.P. brass pillar taps, as specified. The height of top of the rim of wash basin from the floor level shall be within 750 mm to 800 mm.

19.11.2 Fixing

The basin shall be supported on a pair of C.I. cantilever brackets conforming to IS 775 and be embedded in cement concrete (1:2:4) block 100 x 75 x 150 mm. Use of M.S. angle or Tee section as bracket is not permitted. Brackets shall be fixed in position before dado work is done. The brackets have been shown in Fig. 17.15. The wall plaster on the rear shall be cut to rest over the top edge of the basin so as not to leave any gap for water to seep through between wall plaster & skirting of basin. After fixing the basin, plaster shall be made good and surface finished matching with the existing one. S.C.I. floor traps conforming to IS 1729 having 50 mm water seal (minimum 35 mm in two pipe systems with gully trap) should be used. W aste pipes laid horizontally should have gradient not flatter than 1 in 50 and not steeper than 1 in 10.If waste pipe is concealed or crosses the wall, waste water shall be discharged through non ferrous trap like PVC Engineering plastic or C.P. brass and union to vertical stack. The C.P. brass trap and union shall be paid for separately. Where so specified a 20 mm G.I. puff pipe terminating with a perforated brass cap screwed on it on the outside of the wall or connected to the antisyphon stack shall be provided.

19.12 INSTALLATION OF SQUATTING PAN

19.12.1 The installation shall consist of squatting pan, flushing cistern, flush pipe and a pair of foot rests.

19.12.2 Fixing The pan shall be sunk into the floor and embedded in a cushion of average 15 cm thick cement concrete 1:5:10 (1 Cement : 5 fine sand : 10 graded brick ballast 40 mm nominal size). The concrete shall be left 115 mm below the top level of the pan so as to allow flooring and its bed concrete. The pan shall be provided with a 100 mm S.C.I., P or S type trap with an

approximately 50 mm seal and 50 mm dia vent horn, where required by the Engineer-in-Charge. The joint between the pan and the trap shall be made leak proof with cement mortar 1:1 (1cement:1 fine sand).

19.13 INSTALLATION OF WATER CLOSET

19.13.1 Installation shall consist of water closet with seat and cover, flushing cistern and flush bend.

19.13.2 **Fixing:** The closet shall be fixed to the floor by means of 75 mm long 6.5 mm diameter counter-sunk bolts and nuts embedded in floor concrete.

19.14 INSTALLATION OF FOOT RESTS

19.14.1 After laying the floor around squatting pan as specified a pair of foot rests shall be fixed in cement mortar 1 : 3 (1 cement : 3 coarse sand).

19.15 INSTALLATION OF SQUATTING PLATE (SINGLE OR RANGE):

19.15.1 The installation shall consist of an assembly of squatting plates (single or range), vitreous China channel, automatic flushing cistern, flush pipe with fittings spreader and C.I. trap. The capacity of flushing cistern and relevant size of flush pipes shall be as specified in Table 19.4.

TABLE 19.4

19.15.2 **Fixing:** The floor slab shall be suitably sunk to receive the squatting plate. Where the floor slab is not sunk, the plates shall be provided over a platform. The top edge of the squatting plate shall be flush with the finished floor level adjacent to it. It shall be embedded on a layer of 25 mm thick cement mortar 1:8 (1 cement: 8 fine sand) laid over a bed of cement concrete 1:5:10 (1 cement: 5 fine sand: 10 graded brick aggregate 20 mm nominal size).There shall be 100 mm dia, white glazed vitreous China channels with stop and outlet pieces suitably fixed in the floor in cement mortar 1:3 (1 cement :3 coarse sand) and joint finished with white cement. The squatting plate shall have 1200 high and half brick thick wall in front and on either side of the squatting plate. The brick work for the walls shall be paid separately. The exposed surface of walls shall be lined with white glazed tiles with proper corners and angles set in neat cement mortar, the face of the joints shall be gone over with whiting so as to match with the colour of the tiles. The tiles shall be 15 mm square. Space if any, left between the side walls and squatting plate shall be finished white to match the colour of the squatting plate. The trap and fittings shall be fixed as directed by the Engineer-in-Charge. The vitreous China channel shall discharge into 65 mm diameter standard urinals, C.I. trap with vent arm having 65 mm C.P. brass outlet grating.

19.16 INSTALLATION OF TOWEL RAIL

It shall be fixed in position by means of C.P. brass screws on wall surface by PVC dash fasteners, firmly embedded in wall.

#NOTE: All the measurements taken from CPWD specifications Vol-II, Chapter

20.1 Water Supply Work

List of Codes to be followed for Sanitary Installation Works are as below

S. No.	Codes.	Subject
1.	IS 554	Pipe threads where pressure tight joints are required on the threads- Dimensions, tolerances and designation.
2.	IS 780	Specification for sluice valves for water works purposes (50 to 300 mm size)
3.	IS 781	Specification for cast copper alloy screw down bib taps and stop valves for water services
4.	IS 909	Underground fire hydrant, sluice valve type-Specification
5.	IS 1239 (Part-1)	Steel tubes tubular and other wrought steel fittings, Part 1-Steel tubes-Specification
6.	IS 1239 (Part-2)	Specification for mild steel tubes tubular and other wrought Steel fittings, Part 2-Mild street tubular and other wrought steel pipe
		fittings
7.	IS 1536	Centrifugally cast (spun) iron pressure pipes for water gas and sewage- Specification
8.	IS 2692	Ferrules for water services- Specification
9.	IS 5382	Rubber sealing rings for gas mains, water mains and sewers
10.	IS 9763	Plastic Bib taps and stop valves (rising spindle) for cold water services- specifications
11.	IS 15778	Chlorinated Polyvinyl Chloride (CPVC) pipes for potable hot and cold water distribution supplies-specifications.

20.1 WATER SUPPLY

20.1.1 All various water supply general requirements are given in CPWD specifications Vol- II, 2009, chapter-18.

20.2 MATERIALS:

20.2.1 The standard size of brass or gun metal fittings shall be designated by the nominal bore of the pipe outlet to which the fittings are attached. A sample of each kind of fittings shall be got approved from the Engineer-in-Charge and all supplies made according to the approved samples.

20.2.2 Ball Valve (Brass)

The ball valve shall be of Brass or Gunmetal as specified conforming to IS 1703 The ball valve shall be of following two classes:—

(a) High Pressure: High pressure float valves are indicated by the abbreviation 'HP' and are designed for use on mains having pressure of 0.175 MPa or above.

(b) Low Pressure: Low Pressure float valves are indicated by the abbreviation 'LP' and are designed for use on mains having a pressure up to. 0.175 MPa. The ball valves shall be of following nominal sizes 15 mm, 20 mm, 25 mm, 32 mm, 40 mm and 50 mm. The nominal size shall correspond with the nominal bore of the inlet shanks. Polyethylene floats shall conform to IS 9762.

20.2.3 Bib Taps and Stop Valve

A bib tap is a draw off tap with a horizontal inlet and free outlet and a stop valve is a valve with suitable means of connections for insertion in a pipe line for controlling or stopping the flow. They shall be of specified size and shall be of screw down type and shall conform to IS 781. The closing device shall work by means of disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of the threaded spindle which operates it.The handle shall be either crutch or butterfly type securely fixed to the spindle. Valve shall be of the loose leather seated pattern. The cocks (taps) shall open in anti-clock wise direction. The bib tap and stop valve shall be polished bright. The minimum finished weights of bib tap and stop valve shall be as specified in Table 20.1.

Table 20.1 Minimum Finished Mass of Bib Taps and Stop Valves

size	Minimum Finished Mass			
	Bib Taps	Stop Valves		
		Internally Threaded	Externally Threaded	Mixed End
(1)	(2)	(3)	(4)	(5)
m	kg	kg	kg	kg
8	0.250	0.220	0.250	0.235
1	0.300	0.300	0.350	0.325
1	0.400	0.330	0.400	0.365
2	0.750	0.675	0.750	0.710
2	1.250	1.180	1.300	1.250
3	--	1.680	1.800	1.750
4	--	2.090	2.250	2.170
5	--	3.700	3.850	3.750

In case these are required to be nickel plated, the plating shall be of the first quality with a good thick deposit of silvery whiteness capable of taking high polish which will not easily tarnish or scale.

20.2.4 Ferrules

The ferrules for connection with C.I. main shall generally conform to IS 2692. It shall be of non-ferrous materials with a C.I. bell mouth cover and shall be of nominal bore as specified. The ferrule shall be fitted with a screw and plug or valve capable of completely shutting off the water supply to the communication pipe, if and when required.

20.2.5 Fire Hydrants

The hydrant shall conform to IS 909 and shall consist of the following components:

(a) Body (d) Gland (g) Valve

(b) Bonnet (e) Spindle Cap (h) Screwed Outlet

(c) Spindle (f) Spindle Nut (i) Outlet and Chain

The body, bonnet, gland, outlet cap and spindle cap and shall be of good quality cast iron grade FG 200 of IS 210. Outlet, seat for valve, valve, spindle nut, check nut shall be made of copper alloy as per IS 909.

20.2.6 Gate Valve - Gun Metal

These shall be of the gun metal fitted with wheel and shall be of gate valve type opening full way and of the size as specified. These shall generally conform to IS778.

20.2.7 Pig Lead

Pig lead shall be of uniform quality, clean and free from foreign materials. It shall be of uniform softness and capable of being easily caulked or driven. It shall conform to IS 782 for caulking lead in all respects.

20.2.8 Lead Wool

Lead wool shall conform to IS 782 in all respects. Lead wool shall consist of fine strands or plated ribbons of lead. The cross-section of the individual strands shall be flat. The dimensions in the sectional plane shall not be less than 0.13 mm and not more than 0.90 mm and the rope shall be supplied in minimum lengths of two metres and the maximum length in any one package shall be such that the package does not weigh more than 50 Kg.

20.2.9 Non-Return Valve (Gun Metal)

A non-return valve permits water to flow in one direction only and is provided on the ascending part of the main to check return flow. The non-return valve shall be of Gun metal and shall be of horizontal or vertical flow type as specified.

The valve shall be of quality approved by the Engineer-in-Charge and shall generally conform to IS 778.

20.2.10 Pipes and Specials

Pipes and specials may be of any of the following types as specified:

(a) Cast iron centrifugally cast (spun) – IS 1536

(b) Galvanised steel – IS 1239 & IS 4736

(c) PE-AL-PE Pipes – IS 15450

(d) PP-R Pipes – IS 15801

(e) CPVC pipes – IS 15778

20.2.11 Pipes-Galvanised Iron

20.2.11.1 The pipes (tubes) shall be galvanised mild steel hot finished seamless (HFS) or welded (ERW) HRIW or HFW screwed and socketed conforming to the requirements of IS 1239 Part-I for medium grade.

20.2.11.2 Galvanising shall conform to IS 4736 : The zinc coating shall be uniform adherent, reasonably smooth and free from such imperfections as flux, ash and dross inclusions, bare batches, black spots, pimples, lumping runs, rust stains, bulky white deposits and blisters. The pipes and sockets shall be cleanly finished, well galvanised in and out and free from cracks, surface flaws laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with the axis of the tube.

20.2.11.3 The dimensions and weights of pipes and sockets and tolerances shall be as prescribed in Appendix 'C' of CPWD specifications in chapter-18 of Vol-II.

20.2.11.4 All screwed tubes and sockets shall have pipe threads conforming to the requirements of IS 554. Screwed tubes shall have taper threads while the sockets shall have parallel threads.

20.2.11.5 All tubes shall withstand a test pressure of 50 Kg/sq.cm without showing defects of any kind.

20.2.11.6 Fittings: The fittings shall be of mild steel tubular or wrought steel fittings conforming to IS 1239 (Part-2) or as specified. The fittings shall be designated by the respective nominal bores of the pipes for which they are intended.

20.2.12 Shower Rose Brass

The shower rose shall be of chromium plated brass of specified diameter. It shall have uniform perforations. The inlet size shall be 15 mm or 20 mm as required.

20.2.13 Sluice Valves-Brass/Gun Metal

The sluice valves are used in a pipe line for controlling or stopping flow of water. These shall be of specified size and class and shall be of inside non-raising screw type up to 300 mm size and raising or non-raising screw type above 300 mm with either double flange or double socket ends and cap or hand wheel. These shall in all respects comply with the Indian Standard Specification IS 780 for valves up to and including 300 mm size and for valves above 300 mm size. Class I sluice valves are used for maximum working pressure of 10 Kg/sq.cm (100 metre head) and class II sluice valve for 15 Kg/sq.cm (150 metre head).

20.2.14 Surface Box

This shall be of cast iron, well made and free from casting and other defects. All sharp edges shall be removed and finished smooth. The C.I. surface boxes shall be coated with a black bituminous composition except in case of fire hydrants where the cover of the surface box shall be painted with two coats of rust resisting bright luminous yellow paint for clear visibility during night.

20.3 LAYING AND JOINTING OF PIPES AND FITTINGS

20.3.1 Unloading

20.3.1.1 The pipes shall be unloaded where they are required.

20.3.1.2 Unloading (except where mechanical handling facilities are available): Pipes weighing up to 60 kg shall be handled by two persons by hand passing. Heavier pipes shall be unloaded from the lorry or wagon by holding them in loops, formed with ropes and sliding over planks set not steeper than 45 degree.

20.3.2 Storing: Each stack shall contain pipes of same class and size, consignment or batch number and particulars of suppliers, wherever possible, shall be marked on the stack.

20.3.3 Cutting: Cutting of pipes may be necessary when pipes are to be laid in lengths shorter than the lengths supplied, such as while replacing accessories like tees, bends, etc. at fixed position in the pipe lines. The pipe shall be rigidly held on two parallel rafters nailed to cross beams, taking care that the portion to be cut does not overhang and the cut mark is between the two rafters.

20.3.4 Trenches

20.3.4.1 The trenches shall be so dug that the pipes may be laid to the required alignment and at required depth.

20.3.4.2 Cover shall be measured from top of pipe to the surface of the ground.

20.3.4.3 The bed of the trench, if in soft or made up earth, shall be well watered and rammed before laying the pipes and the depressions, if any, shall be properly filled with earth and consolidated in 20 cm layers.

20.3.4.4 If the trench bottom is extremely hard or rocky or loose stony soil, the trench shall be excavated at least 150 mm below the trench grade. Rocks, stone or other hard substances from the bottom of the trench shall be removed and the trench brought

back to the required grade by filling with selected fine earth or sand (or fine moorum if fine soil or sand is not available locally) and compacted so as to provide a smooth bedding for the pipe.

20.3.4.5 After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipes and these hollows shall be of sufficient depth to ensure that the barrels of the pipes shall rest throughout their entire length on the solid ground and that sufficient spaces left for jointing the underside of the pipe joint. These socket holes shall be refilled with sand after jointing the pipe.

20.3.4.6 Roots of trees within a distance of about 0.5 metre from the side of the pipe line shall be removed or killed.

20.3.4.7 The excavated materials shall not be placed within 1 metre or half of the depth of the trench, whichever is greater, from the edge of the trench. The materials excavated shall be separated and stacked so that in refilling they may be re-laid and compacted in the same order to the satisfaction of the Engineer-in-Charge.

20.3.4.8 The trench shall be kept free from water. Shoring and timbering shall be provided wherever required. Excavation below water table shall be done after dewatering the trenches.

20.3.5 Laying

20.3.5.1 The pipes shall be lowered into the trench by means of suitable pulley blocks, sheer legs chains ropes etc. In no case the pipes shall be rolled and dropped into the trench. One end of each rope may be tied to a wooden or steel peg driven into the ground and the other end held by men which when slowly released will lower the pipe into the trench. After lowering, the pipes shall be arranged so that the spigot of one pipe is carefully centered into the socket of the next pipe, and pushed to the full distance that it can go. The pipe line shall be laid to the levels required. Specials shall also be laid in their proper position as stated above.

20.3.5.2 Clearance of approximately 100 mm in depth and width equal to length of the collar plus 30mm on both sides shall be provided at the joint which shall be refilled from sides after the joint is made.

20.3.5.3 The clay forms a tight gripping bond with the pipe, subjecting it to excessive stresses as the clay shrinks. It is recommended that in such cases an envelope of a minimum 100 mm of tamped sand shall be made around the pipe line to avoid any bonding.

20.3.5.4 In places where rock is encountered, cushion of fine earth or sand shall be provided for a depth of 150 mm by excavating extra depth of the trench, if necessary, and the pipes laid over the cushion.

20.3.6 Thrust Blocks

Thrust blocks are required to transfer the resulting hydraulic thrust from the fitting of pipe on to a larger load bearing soil section.

20.3.6.1 Thrust blocks shall be installed wherever there is a change in the direction/size of the pipe line or the pressure line diagram, or when the pipe line ends at a dead end. If necessary, thrust blocks may be constructed at valves also.

20.3.6.2 Thrust blocks shall be constructed taking into account the pipe size, water pressure, type of fitting, gravity component when laid on slopes and the type of soil.

20.3.6.3 If soft soil conditions are encountered, it may be necessary to provide side thrust blocks of other means of anchoring. In such cases only pipe on each side of the deflected coupling shall be anchored without restricting the coupling.

20.3.7 Back Filling and Tamping

20.3.7.1 Back filling shall follow pipe installation as closely as possible to protect pipe from falling boulders, eliminating possibility of lifting of the pipe due to flooding of open trench and shifting pipe out of line by caved in soil.

20.3.7.2 The initial back fill shall be placed evenly in a layer of about 100 mm thick. This shall be properly consolidated and this shall be continued till there is a cushion of at least 300 mm of cover over the pipe.

20.3.7.3 If it is desired to observe the joint or coupling during the testing of mains they shall be left exposed. Sufficient back fill shall be placed on the pipe to resist the movement due to pressure while testing.

20.3.7.4 Pipes in trenches on a slope shall have extra attention to make certain that the newly placed back fill will not become a blind drain in effect because until back fill becomes completely consolidated there is a tendency for ground or surface water to move along this looser soil resulting in a loss of support to the pipe. In such cases, the back fill shall be tamped with extra care and the tamping continued in 100 mm layers right up to the ground level.

20.4 LAYING AND JOINTING OF CAST IRON PIPES AND FITTINGS (EXTERNA WORK)

20.4.1 Specifications described in 20.3 shall apply, as far as applicable.

TABLE 20.3 Test Pressure for Pipes

Class of pipe	Maximum field test pressure kgf./sq.cm
5	3.75
10	7.50
15	11.25
20	15.0
25	18.75

20.4.2 Trenches

20.4.2.1 The gradient is to be set out by means of boning rods and the required depth to be excavated at any point of the trench shall be regarded as directed by the Engineer-in- Charge. The depth of the trench shall not be less than 1 metre measured from the top of the pipe to the surface of the ground under roads and not less than 0.75 metre elsewhere.

20.4.2.2 The width of the trench shall be the nominal diameter of the pipe plus 40 cm but it shall not be less than 55 cm in case of all kinds of soils excluding rock and not less than 1 metre in case of rock.

20.4.3 Laying

Any deviation either in plan or elevation less than 11.25 degrees shall be effected by laying the straight pipes around a flat curve of such radius that minimum thickness of lead at the face of the socket shall not be reduced below 6 mm or the opening between spigot and socket increased beyond 12 mm at any joint. A deviation of about 2.25 degree can be effected at each joint in this way. At the end of each day‘s work the last pipe laid shall have its open ends securely closed with a wooden plug to prevent entry of water, soil, rats and any other foreign matter into the pipe.

20.4.4 Lead Caulked Joints with Pig Lead

20.4.4.1 This type of lead caulking is generally done in providing joints in gas water and sewer lines wherever it is practicable to use cast lead caulking, but not in case of wet conditions.

20.4.4.2 The approximate depth and weights of pig lead for various diameters of C.I. pipes and specials shall be as given in Table 20.4.

TABLE 2 0 .4 Lead for Different Sizes of Pipes

Nominal size of pipe mm.	Lead per joint Kg.	Depth of lead joint mm.
(1)	(2)	(3)
80	1.8	4
100	2.2	45
125	2.6	45
150	3.4	50
200	5.0	50
250	6.1	50
300	7.2	55
350	8.4	55
400	9.5	55
450	14.0	55
500	15.0	60
600	19.0	60
700	22.0	60
750	25.0	60

Note: The quantity of lead given in the table is on average basis and a variation of 10 per cent is permissible.

20.4.5 Lead Caulked Joint with Lead Wool Yarn

20.4.5.1 When it is inconvenient or dangerous to use molten lead for joints, for example in cases such as inverted joints or in wet trenches or in exceptional cases. In such cases the joints shall be made with lead wool or yarn. Caulking with lead wool or yarn shall however be not carried out without the prior permission of Engineer-in-Charge.

20.4.5.2 The approximate weights and depths of lead wool or lead yarn required for each joint of various dia. of C.I. pipes and specials shall be as given in Table 20.5.

20.4.5.3 Jointing: The spun yarn shall first be inserted and caulked into the socket as described under jointing with pig lead. Lead wool or yarn shall then be introduced in the joint in strings not less than 6 mm thick and the caulking shall be repeated with each turn of lead wool or yarn. The whole of the lead wool or yarn shall be compressed into a dense mass.

20.4.6 Flanged joints

20.4.6.1 Cast iron pipes may be jointed by means of flanges cast on. The jointing material used between flanges of pipes shall be compressed fiber board or rubber of thickness between 1.5 mm to 3 mm. The fiber board shall be impregnated with chemically neutral mineral oil and shall have a smooth and hard surface. Its weight per m2 shall be not less than 112 gm/mm thickness.

TABLE 20.5

Diameter pipe (mm)	Weight of lead lead wool or yarn (kg)	Depth of lead wool or lead yarn (mm)
80	0.80	9
100	0.90	19
125	1.25	20
150	1.60	23
200	2.05	23
250	2.95	25
300	3.50	25
350	4.65	29
400	5.70	31
450	6.70	32
500	8.30	33
600	10.00	35
700	11.80	36
750	13.60	38
800	15.40	40
900	16.80	40

Note: An allowance of five per cent variation in the specified weights and depths is permissible.

20.4.6.2 Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The practice of fully tightening the bolts one after another shall not be allowed.

20.4.6.3 For joints in small diameter cast iron piping, copper-alloy screwed unions or ferrules shall be used, and for large dia. The joints shall be made by flanged connecting pieces.

20.4.7 Hydrostatic

The procedure for testing for leakage under pressure shall be as described in Appendix D of Chapter 18 which is to be read in CPWD pacifications ,Vol-II. The joints of pipes and specials have to be repaired till the leakage in the portion under test is within the specified limit indicated in Appendix-D of Chapter 18 of CPWD specifications, Vol-II.

20.5 LAYING AND JOINTING OF G.I. PIPES (EXTERNAL WORK)

20.5.1 The specifications described in 18.3 in CPWD specifications Vol-II, 2009, chapter-18 shall apply, as far as applicable.

20.5.2 Trenches

The galvanised iron pipes and fittings shall be laid in trenches. The widths and depths of the trenches for different diameters of the pipes shall be as in Table 20.6.

TABLE 2 0.6

Dia of pipe (mm)	Width of trench (cm)	depth of trench (cm)
15 to 50	0	60
65 to 100	5	75

At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for earth work in trenches.

When excavation is done in rock, it shall be cut deep enough to permit the pipes to be laid on a cushion of and minimum 7.5 cm deep.

20.5.3 Cutting and Threading

Where the pipes have to be out or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The end of the pipes shall then be carefully threaded conforming to the requirements of IS 554 with pipe dies and tapes in such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in a water tight joint. The screw threads of pipes and fitting shall be protected from damage until they are fitted.

20.5.4 Jointing

The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over. **Teflon Tape** should be used on threads instead of **'Dhaaga/ Safeda'**. The end shall then be screwed in the socket, Tee etc. with the pipe wrench. Burr from the joint shall be removed after screwing. After laying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

20.5.5 Thrust Blocks

In case of bigger diameter pipes where the pressure is very high, thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) of adequate size and shape shall be provided on all bends to transmit the hydraulic thrust to the ground, spreading it over a sufficient areas, depending upon the type of soil met with.

20.5.6 Painting

The pipes shall be painted with two coats of anticorrosive bitumastic paint of approved quality.

20.5.7 Testing of Joints

The pipes and fittings after they are laid and jointed shall be tested to hydraulic pressure of 6 Kg/sq.cm (60 meter). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least half an hour.

20.5.8 Trench Filling

The pipes shall be laid on a layer of 7.5 cm sand and filled up to 15 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth as described in 20.3.7. The surplus earth shall be disposed off as directed.

20.6 INSTALLATION OF FIRE HYDRANT

20.6.1 The hydrant shall be fully examined and cleared of all foreign matter before being fixed. The fixing shall be done on the water main which shall be of minimum 80 mm dia. The flanged end of the hydrant shall be fixed to the flanged outlet of a tee in the water main by means of bolts, nuts and 3 mm rubber insertion or chemically treated compressed fiber board 1.5 mm minimum thickness and of weight not less than 0.183 gm. per sq.cm. This can also be fixed by means of flanged tail piece which may be connected to the water main by C.I. specials.

20.7 INSTALLATION OF SLUICE VALVE

20.7.1 The valve shall be fully examined and cleared of all foreign matter before being fixed. The fixing of the valve shall be done by means of bolts, nuts and 3 mm rubber insertions or chemically treated compressed fiber board 1.5 mm minimum thickness and of weight not less than 0.183 gm./sq.cm. with the flanges of spigot and the socketed tail pieces drilled to the same specification in case of S&S pipes and with flanges in case of flanged pipes. The tail pieces shall conform to IS 1938. These shall be jointed to the pipe line by means of lead caulked joints.

20.8 POLYETHYLENE WATER STORAGE TANKS

20.8.1 Material

Polyethylene used for manufacture of tanks and manhole lids may be high density (HDPE), low density (LDPE) or linear low density (LLDPE) and shall conform to IS10146. Polyethylene shall be compounded with carbon black so as to make the tank resistant to ultra violet rays from the sun. The percentage of carbon black content in polyethylene shall be 2.5 ± 0.5 percent and it shall be uniformly distributed. The materials used for the manufacture of tank, manhole lid and fittings shall be such that they neither contaminate the water nor impart any taste, colour, odour or toxity to water.

20.8.2 Manufacture and Finish

The tanks shall be manufactured by rotational moulding process. Each tank and the manhole lid shall be single piece having arrangement for fixing and locking the manhole lid with the tanks. Excess material at the mould parting line and near the top rim shall be neatly cut and finished. The internal and external surface of the tanks shall be smooth, clean and free from hidden internal defects like air bubbles, pit and metallic or other foreign material inclusion.

20.8.3 Shape, Size and Capacity

The tank shall be cylindrical vertical with closed top having a manhole. Diameter and height of the tank of various capacities shall be as per manufacturer‘s specifications and a clearance of ± 3 percent shall be permitted on these dimensions.

20.8.4 Weight and Wall Thickness

Minimum weight of the empty tank (exclusive of manhole lid fittings) and the minimum wall thickness of top, bottom and sides shall be specified in Table 18.23. Wall thickness shall be checked beyond 150 mm of the edge where the direction the plane of tank surface changes.

20.8.5 Installation and Fittings

Depending upon the capacity and location tanks may be suitably anchored as per the directions of the Engineer-in-Charge. For inlet, outlet and other connections fully threaded GI, HDPE or PVC connections with hexagonal check nuts and washers on either side of the tank wall shall be provided. Holes for threaded connections shall be drilled and not punched.

20.8.6 Manhole Lid

The lid shall rest evenly and fit over the rim of the manhole so as to prevent the ingress of any foreign matter into the tank. The lid shall be provided with suitable arrangement for locking it with the tank.

20.8.7 The tank and its components shall conform to the local bye-laws for.

21.1 Drainage Work

List of Codes to be followed for Drainage Works are as below:

S. No.	IS No.	Subject
1.	IS 458	Pre-cast Concrete Pipes (with and without reinforcement).
2.	IS 651	Specification for Salt Glazed Stoneware Pipes and Fittings.
3.	IS 783	Code of Practice for Laying Concrete Pipes
4.	IS 1726	Specification for Cast Iron Manhole Covers and Frames
5.	IS 1729	Cast Iron /Ductile Iron Drainage Pipes and Pipe Fittings Socket and Spigot Series for Over-ground Non-pressure Pipe Line.
6.	IS 4127	Code of Practice for Laying of Glazed Stone Ware Pipes
7.	IS 4885	Specifications for Sewer Bricks
8.	IS 12592	Pre-cast Concrete Manhole Covers and Frames – Specifications

21.2 GENERAL REQUIREMENTS

21.2.1 In designing a drainage system for building(s), the aim shall be to provide a self cleansing conduit for the conveyance of soil, waste, surface or sub-surface waters and for the removal of such wastes speedily and efficiently to a sewer or other outlet, without risk of nuisance and hazard to health.

21.2.2 The discharge of water through a domestic drain is intermittent and limited in quantity and therefore, small accumulations of solid matter are liable to form in the drains between the building and the public sewer. There is usually a gradual shifting of these deposits as discharges take place. Gradients shall be sufficient to prevent these temporary accumulations building up and blocking the drains.

TABLE 21.1Gradients for Sewers

Diameter mm	Minimum Gradient		Maximum Gradient	
	Gradients	Discharge cum/Min.	Gradients	Discharge cum/Min.
100	1 in 57	0.18	1 in 5.6	0.59
150	1 in 100	0.42	1 in 9.7	1.32
200	1 in 145	0.73	1 in 14	2.4
230	1 in 175	0.93	1 in 17	2.98
250	1 in 195	1.10	1 in 19	3.60
300	1 in 250	1.70	1 in 24.5	5.30

21.3 PIPES AND SPECIALS

21.3.1 Glazed Stone Ware Pipes and Fittings

All pipes with spigot and socket ends and fittings shall conform to class SP1 of IS 651. These shall be sound, free from visible defects such as fire cracks or hair

cracks. The glaze of the pipes shall be free from crazing. The pipes shall give a sharp clear tone when struck with a light hammer. There shall be no broken blisters.The thickness of pipes shall be as given in the Table 21.2.

TABLE 21.2 Stoneware Pipes

Internal Diameter (mm)	Mean Thickness of the Barrel and Socket (mm)
100	12
150	15
200	16
230	19
250	20
300	25
350	30
400	35
450	37

The length of pipes shall be 60, 75, 90 cm exclusive of the internal depth of the socket. The pipes shall be handled with sufficient care to avoid damage to them.

21.3.1.1 S.W. Gully Trap: Gully traps shall conform to IS 651. These shall be sound, free from visible defects such as fire cracks, or hair cracks. Each gully trap shall have one C.I. grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 x 300 mm the cover weighing not less than 4.50 Kg and the frame not less than 2.70 Kg. The grating, cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

21.3.1.2 Laying and Jointing Stone Ware Pipes: For all sewers and drains, glazed stoneware pipes shall be used as far as possible in preference to other types of pipes. These are suitable, particularly where acid effluents or acid sub-soil conditions are likely to be encountered.

(i) Trenches: Specifications described in chapter-19 of CPWD specifications, VOL-II, 2009 shall apply, as far as possible. When the pipe line is under a roadway, a minimum cover of 90 cm is recommended for adoption, but it may be modified to suit local conditions. Unless otherwise specified by the Engineer-in-Charge, the width at bottom of trenches for different diameters of pipes laid at different depths shall be as given below:—

(a) For all diameters, up to an average depth of 120 cm, width of trench in cm = diameter of pipe + 30 cm.

(b) For all diameters for depths above 120 cm, width of trench in cm = diameter of pipe + 40 cm.

(c) Notwithstanding (a) and (b) the total width of trench shall not be less than 75 cm for depths exceeding 90 cm. The width of trench in the upper reaches shall be increased as described in sub-head 'Earthwork'.

(ii) Laying: Where the pipes are laid on soft soil with maximum water table lying at invert level of the pipe, the pipes shall be bedded in cement concrete with thickness and mix as specified, projecting on each side of the pipe to the specified width of the trench .The pipes with their crown level at 1.20 m depth and less from ground shall be covered with 15 cm thick. Concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm all-around the pipe. Pipes laid at a depth greater than 1.20 m at crown and maximum water table level rising above the

invert level of pipe, shall be concreted at the sides up to the level of the centre of the pipe and sloped off from the edges to meet the pipe tangentially. Where pipes are not bedded on concrete, the trench floor shall be left slightly high and carefully bottomed up as pipe laying proceeds, so that the pipe barrels rest on firm and undisturbed ground. If the excavation has been carried too low, the desired levels shall be made up with concrete 1:5:10 (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size) for which no extra payment shall be made. When S.W. pipes are used for storm water drainage, no concreting will normally be necessary. The cement mortar for jointing will be 1:3 (1cement: 3 fine sand). Testing of joints will also not be done. (iii)Jointing: Tarred gasket or hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be slipped home well into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more than 1/4th of the total depth of the socket.

The remainder of the socket shall be filled with stiff mixture of cement mortar in the proportion of 1:1 (1cement: 1 fine sand). When the socket is filled, a fillet shall be formed round the joint with a trowel forming an angle of 45 degree with the barrel of the pipe. After a day‘s work any extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured for at least seven days.

(iv)Testing of Joints: Stoneware pipes used for sewers shall be subjected to a test pressure of 2.5 m head of water at the highest point of the section under test. Before commencing test, the pipeline shall be filled with water and maintained full for 24 hours under head of 0.6 m of water. The test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head, or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation. The tolerance of two liters per centimeter of diameter per kilometer may be allowed during a period of 10 minutes. Any joint found leaking or sweating, shall be rectified or embedded into 15 cm layer of cement concrete (1:2:4) 30 cm in length and the section retested.

(v) Refilling: In cases where pipes are not bedded on concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe, and rammed with a shovel and light tamper. This method of filling will be continued up to the top of pipe. The refilling shall rise evenly on both sides of the pipe continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe.

(vi) Measurements: The lengths of pipes shall be measured in running metres nearest to a cm as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the centre line of the pipes over all fittings such as bends, junctions, etc. which shall not be measured separately.

21.3.1.3 Fixing S.W. Gully Trap

(**i) Excavation:** The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Engineer-in-Charge.

(ii) Fixing: The gully traps shall be fixed on cement concrete foundation 65 cm square and not less than 10 cm thick. The mix for the concrete will be 1:5:10 (1cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size). The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipes described above.

(iii) Brick Masonry Chamber: After fixing and testing gully and branch drain, a brick masonry chamber 300 x 300 mm (inside) in brick work of specified class in cement mortar 1:4 (1 cement:4 fine sand) shall be built with a half brick thick brick work round the gully trap from the top of the bed concrete up to ground level. The space between the chamber walls and the trap shall be filled in with cement concrete 1:5:10 (1cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size). The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside with cement mortar 1:3 (1 cement: 3 coarse sand), finished with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating. C.I. cover with frame 300 × 300 mm (inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) and rendered smooth. The finished top of cover shall be left about 4 cm above the adjoining ground level so as to exclude the surface water from entering the gully trap.

(iv) Measurements: The work shall be enumerated. Excavation shall be measured separately under relevant item of earth work.

21.3.2 Cement Concrete Pipes (with and without Reinforcement) (Light Duty, Non-Pressure) The pipes shall be with or without reinforcement as required and shall be of class not lesser than NP2. These shall conform to IS 458 and shall be capable of withstanding a test pressure of 0.07 MPa (7 m head). The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process while un- reinforced cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws.

Concrete used for the manufacture of un-reinforced and reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate). The maximum size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller for pipes above 250 mm internal diameter. But for pipes of internal diameter 80 to 250 mm, the maximum size of aggregate should be 10mm. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight. The dimensional requirements of concrete pipes are given in Appendix I of chapter-19 of CPWD specifications, VOL-II, 2009. The minimum clear cover for reinforcement in pipes and collars shall be as given in Table 21.3.

TABLE 21.3

Sl. No.	Precast concrete pipe/collar	Minimum clear cover, mm
(i)	Barrel wall thickness	
(a)	Upto and including 75 mm	8
(b)	Over 75 mm	15
(ii)	At spigot steps	5
(iii)	At end of longitudinal	5

21.3.2.1 Laying and Jointing Cement Concrete Pipes and Specials

(i) Trenches: Trenches shall be as described in earlier. Where the pipes are to be bedded directly on soil, the bed shall be suitably rounded to fit the lower part of the pipe, the cost for this operation being included in the rate for laying the pipe itself.

(ii) Jointing: Joints are generally of rigid type. Where specified flexible type joints may also be provided.

(a) **Rigid Spigot and Socket Joint:** The spigot of each pipe shall be slipped home well into the socket of the pipe previously laid and adjusted in the correct position. The opening of the joint shall be filled with stiff mixture of cement mortar in the proportion of 1:2 (1 cement: 2 fine sand) which shall be rammed with caulking tool. After a day‘s work any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

(b) **Rigid Collar Joint :** The two adjoining pipes shall be butted against each other and adjusted in correct position. The collar shall then be slipped over the joint, covering equally both the pipes. The annular space shall be filled with stiff mixture of cement mortar 1:2 (1 cement: 2 fine sand) which shall be rammed with caulking fool. After a day‘s work any extraneous materials shall be removed from the inside of the pipe and the newly made joint shall be cured.

(c) **Semi Flexible Spigot and Socket Joint :** The joint is composed of specially shaped spigot and socket ends on the concrete pipes. A rubber ring shall be placed on the spigot which shall be forced into the socket of the pipe previously laid. This compresses the rubber ring as it rolls into the annular space formed between the two surfaces of the spigot and the socket, stiff mixture of cement mortar 1:2 (1 cement: 2 fine sand) shall then be filled into the remaining annular space and rammed with a caulking tool. After day‘s work any extraneous materials shall be removed from the inside of the pipe and the newly made joint shall be cured.

(d) **Semi Flexible Collar Joint:** This is made up of a loose collar which covers two specially shaped pipe ends. Each end shall be fitted with a rubber ring which when compressed between the spigot and the collar, seal the joint. Stiff mixture of cement mortar 1:2 (1 cement: 2 fine sand), shall then be filled into the remaining annular space and rammed with a caulking tool. After day‘s work, any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured. (e) Internal Flush Joint: This joint is generally used for culvert pipe of 60 cm dia and over. The ends of the pipe are specially shaped to form a self centering joint with an internal jointing space 1.3 cm wide the finished joint is flush with both inside and outside with the pipe wall. The jointing space is filled with cement mortar 1:2 (1 cement: 2 fine sand) mixed sufficiently dry to remain in position when forced with a trowel or rammer. After day‘s work, any extraneous

material shall be removed from the inside of the pipe and the newly made joint shall be cured.

(f) **External Flush Joint :** This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends. Each end shall be butted against each other and adjusted in correct position. The jointing space shall then be filled with cement mortar 1:2 (1 cement: 2 fine sand) sufficiently dry and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

(iii) In all pressure pipe lines the recess at the end of the pipe line shall be filled with jute braiding dipped in hot bitumen or other suitable approved compound. Pipes shall be so jointed that the bitumen ring of one pipe shall set into the recess of the next pipe. The ring shall be thoroughly compressed by jacking or by any other suitable method.

(iv) **Testing:** For pressure pipes, the completed pipeline shall be tested for pressure (Known as site test pressure) which shall not be less than the maximum pipeline operating pressure plus the calculated surge pressure, but in no case shall it exceed the hydrostatic test pressure. For nonpressure pipes the joints shall be tested as given in chapter-19 of CPWD specifications, VOL-II,2009.

(v) **Refilling of Trenches:** The specification described in chapter-19 of CPWD specifications, VOL-II,2009 shall apply. In case where pipes are not bedded on concrete special care shall be taken in refilling, trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe and rammed with a shovel and light tamper. This method of filling will be continued up to the top of pipe. The refilling shall rise evenly on both sides of the pipe and continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping shall be done within 15 cm of the top of pipe. The tamping shall become progressively heavier as the depth of the backfill increases.

(vi) **Measurements :** The lengths of pipes shall be measured in running metres nearest to a cm as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the centre line of the pipes over all fittings such as bends, collars, junctions, etc. which shall not be measured separately. Excavation, refilling, shoring and timbering in trenches, and cement concreting wherever required shall be measured separately under relevant items of work.

21.3.3 Cast Iron (Centrifugally Cast) Pipes and Specials

Cast iron (centrifugally cast) pipes and specials shall conform to the specifications described in chapter-19 of CPW D specifications, VOL-II,2009.

21.3.4 Road Gully Grating

21.3.4.1 **Horizontal Gully Grating:** The casting of the grating and frames shall be the same as that of manhole covers described in 19.2.2.1 in chapter-19 of CPW D specifications, VOL-II, 2009. The gully grating cover shall be hinged to the frame to facilitate its opening for cleaning and repairs.

21.3.4.2 **Vertical Gully Grating:** The chamber shall be of brick masonry, 12 mm dia, round bar shall be fixed in cement concrete block at the bottom.

21.3.4.3 Horizontal and Vertical Gully Grating: The details of typical road gully chamber of brick masonry with horizontal and vertical grating shall be as given in chapter-19 of CPWD specifications, VOL-II,2009.

21.4 MANHOLE COVERS & FRAMES

21.4.1 Manhole Covers

The covers and frames shall conform to IS 1726 for cast Iron and IS 12592.

21.4.1.1 Cast Iron Manhole Covers and Frames

(i) Manhole covers and frame shall be manufactured from appropriate grade of grey cast iron not inferior than FG150 grade of IS 210.

(ii) They shall be cleanly cast and shall be free from air and sand holes, cold shuts and warping.

(iii) Covers shall have on its operative top a raised chequered design to provide for an adequate no-slip grip. The rise of chequers shall be not less than 4mm.

(iv) Key holes, keys and lifting devices shall be provided in the manhole covered to facilitate their placement in the frames and their operative maintenance.

(v) Manhole covers and frames shall be coated with materials having base with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to temperature of 63°C and shall not be so brittle as to chip off at temperature of 0°C.

(vi) Size and shape and performance requirement of manhole covers and frames shall conform to IS 1726.

(vii) Each manhole covers and frame shall have cast on them the following information:

(a) Manufacturer‘s name or trade-mark

(b) Grade designation

(c) Date of manufacturer

(d) The words SWD or ‘Sewer‘ to denote ‘storm water drain’ or ‘sewer‘ respectively

(e) Identification marks as required by Engineer-in-Charge.

(viii) The cover shall be gas tight and water tight.

(ix) The sizes of covers specified shall be taken as the clear internal dimensions of the frame.

(x) The approximate weight of the various type of manhole covers and frames shall be as per IS 1726.

(xi) The cover shall be capable of easy opening and closing and it shall be fitted in the frame in workmanship like manner.

21.4.2 Pre-Cast Concrete Manhole Covers & Frames

Pre-cast reinforced cement concrete manhole covers intended for use in sewerage and water works shall generally conform to IS 12592.

21.4.2.1 Materials

Cement: Cement used for the manufacture of pre-cast concrete manhole covers shall be 43 grade Portland cement conforming to IS-8112.

Aggregates: The aggregates used shall be clean and free from deleterious matter and shall conform to the requirements of IS-383. The aggregates shall be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm. Concrete: The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing etc. The minimum cement content in the concrete shall be

410 kg/m3 with a maximum water cement ratio of 0.45. Concrete weaker than grade M30 (design mix) shall not be used. Compaction of concrete shall be done by machine vibration. Reinforcement

(a) The reinforcement steel shall conform to IS 1786. Reinforcement shall be clean and free from loose mill scale, loose rust, and mud, oil, grease or any other coating which may reduce or destroy the bond between the concrete and steel. A light film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

(b) Fibers Steel: The diameter/equivalent diameter of steel fibers where used, shall not be greater than 0.75 mm. The aspect ratio shall be in the range of 50 to 80. The minimum volume of fibers shall be 0.5 percent of the volume of concrete. The reinforced concrete manhole cover and frame shall be designed in accordance with the provisions of IS 456. Clear cover to reinforcement shall not be less than 15 mm.

21.4.2.2 Shapes and Dimensions: Shape, dimensions and tolerance of pre-cast concrete manhole covers and frames shall conform to IS 12592. Outside dimension of cover at top shall match with corresponding frame so that the maximum clearance at top between the frame and the cover all round the periphery is not more than 5 mm and the top surface of the frame and covers, is in level within a tolerance of +5 mm.

21.4.2.3 Lifting Device: The minimum diameter of mild steel rod used as lifting device shall be 12 mm for light and medium duty covers and 16 mm for heavy and extra heavy duty covers. The lifting device shall be protected from corrosion by hot galvanising or epoxy coating or any other suitable treatment.

21.4.2.4 Finishing & Coating: To prevent any possible damage from corrosion of steel the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish.

21.4.2.5 Physical Requirements

(a) General: All units shall be sound and free from cracks and other defects which interface with the proper placing of the unit or impair the strength or performance of the units. Minor chipping at the edge/surface resulting from the customary methods of handling during delivery shall not be deemed for rejecting.

(b) Load Test: The breaking load of individual units when tested in accordance with the method described in IS 12592 shall be not less than the values specified in Table 21.4.

Table:21.4

Grade of Cover	Type	Load in Tonnes	Diameter of Blocks in
EHD - 35	Circular, Square or Rectangular	35	300
HD - 20	Circular, Square or Rectangular	20	300
MD - 10	Circular or Rectangular	10	300
LD - 2.5	Rectangular, Square or Circular	2.5	300

21.4.2.6 Fixing: The frames of manhole shall be firmly embedded to correct alignment and level in RCC slab or plain concrete as the case may be on the top of masonry which shall be paid as extra unless specified otherwise.

21.4.2.7 Measurements: The manhole covers shall be enumerated under relevant items.

21.4.2.8 Foot Rests: Foot rests shall be of 20 mm M.S. square or round bars as specified.

21.5 OPEN SURFACE DRAIN

21.5.1 The size of the drain as specified shall be the width of the drain at the top, measured between the masonry walls. The drain shall be given, as far as possible, uniform slope from the starting point to the discharge point.

The average depths of the various sizes of drains shall be as follows:—

Drain size	Depth
10 cm	20 cm
15 cm	20 cm
25 cm	30 cm

21.5.2 Measurements

The drains shall be measured in running metres, correct to a cm.

22.1 HORTICULTURE WORK

Horticultural operations shall be started on ground previously levelled and dressed to required formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or, replaced or it shall be covered over to a thickness decided by the Engineer-in-charge with good earth.

22.2 TRENCHING IN ORDINARY SOIL

22.2.1 Trenching is done in order to loosen the soil, turn over the top layer containing weeds etc. and to bring up the lower layer of good earth to form a proper medium for grassing, regrassing, hedging and shrubbery. Trenching shall be done to the depth ordered by the Engineer-in-charge. The depth is generally 30 cm for grassing and 60 cm for regrassing in good soil.

22.2.2 Trenching

Trenching shall consist of the following operations:

1. The whole plot shall be divided into narrow rectangular strips of about 1.5 m width or as directed by the Engineer-in-Charge.
2. These strips shall be sub-divided lengthwise into about 1 m long sections. Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceding it.
3. In excavating and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layer of trenched area, the dead plants so buried incidentally being formed into humus.
4. The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with leads is practically eliminated.

22.2.3 Measurements

Length and breadth of the plot shall be taken correct to 0.1 m and depths correct to cm. Cubical contents shall be calculated in cubic meters, correct to two places of decimal. No deduction shall be made nor extra paid for removing stones, brick bats and other foreign matter met with during excavation upto initial lead of 50 m and stacking the same.

22.3 GOOD EARTH

22.3.1 The earth shall be stacked at site in stacks not less than 50 cm high and of volume not less than 3.0 cum.

22.3.2 **Measurements:** Length, breadth and height of stacks shall be measured correct to a cm. The volume of the stacks shall be reduced by 20% for voids before payment, unless otherwise described.

22.4 ROUGH DRESSING OF THE TRENCHED GROUND

22.4.1 Rough dressing of the area shall include making kiaries for flooding.

22.4.2 The trenched ground shall be levelled and rough dressed and if there are any hollows and depressions resulting from subsidence which cannot be so levelled, these shall be filled properly with earth brought from outside to bring the depressed surface to the level of the adjoining land and to remove discontinuity of slope and then rough dressed again. The supply and spreading of soil in such depressions is payable separately. In rough dressing, the soil at the surface and for 75 mm depth below shall be broken down to particle size not more than 10 mm in any direction.

22.5 UPROOTING WEEDS FROM TRENCHED AREAS

22.5.1 After 10 days and within 15 days of flooding the rough dressed trenched ground with water, the weeds appearing on the ground shall be rooted out carefully and the rubbish disposed off as directed by the Engineer-in-charge.

22.5.2 Measurements

Length, breadth of superficial area shall be measured correct to 0.1 meters. Superficial area of the weeded ground shall be measured for purpose of payments.

22.6 SPREADING SLUDGE/MANURE

22.6.1 Good earth shall be thoroughly mixed with sludge or manure in specified proportion as described in the item or as directed by the Engineer-in-Charge.

22.6.2 Measurements

The quantity of good earth and sludge or manure mixed shall be determined by the difference in the volume of good earth and sludge or manure in stack, before and after spreading duly accounted for voids and looseness in stack.

22.7 MIXING OF GOOD EARTH AND SLUDGE/MANURE

22.7.1 The stacked earth shall, before mixing be broken down top particle of sizes not exceeding 6 mm in any direction.

22.7.2 **Measurements:** The quantity of good earth and sludge or manure mixed shall be determined by the difference in the volume of good earth, sludge or manure in stack, before and after spreading duly accounted for voids and looseness in stack.

22.8 EXCAVATION AND TRENCHING FOR PREPARATION OF BEDS FOR HEDGE AND SHRUBBERY

22.8.1 Beds for hedges and shrubbery are generally prepared to width of 60 cm. to 125 cm. and 2 to 4 meters respectively.

22.8.2 Beds for hedges and shrubbery shall be prepared in the following manner. The beds shall first be excavated to a depth of 60 cm. and the excavated soil shall be stacked on the sides of the beds. The surface of the excavated bed shall then be trenched to a further depth of 30 cm, in order to loosen the soil. The excavated soil from the top 60 cm depth of the bed stacked at the site shall then be thoroughly mixed with sludge over manner in the proportion 8:1 by ratio or other proportion described in the item. The mixed earth and manure shall be refilled over the trenched bed, levelled neatly and profusely flooded so that the water reaches even the bottom most layers of the trenched depth of the bed. The surface after full subsidence shall again be refilled with the earth and manure

mixture, watered and allowed to settle and finally fine dressed to the level of 50 mm to 75 mm below the adjoining ground or as directed by the Engineer-in-Charge. Surplus earth if any, shall be disposed off as directed by the Engineer-in-charge.

22.8.3 Measurements

Length, breadth and depth of the pit excavated and trenched shall be measured correct to a cm. The cubical contents shall be calculated in cubic meter correct to two places of decimal.

22.9 DIGGING HOLES FOR PLANTING TREES

22.9.1 In ordinary soil, including refilling earth after mixing with oil cake, manure and watering.

22.9.1.1 Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and excavate soil broken to clods of size not exceeding 75 mm in any direction, shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the size as directed.

The tree holes shall be manured with powdered Neam/castor oil cake at the specified rate along with farm yard manure over sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particle not be exceeded 6 mm in any direction) in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then profusely watered and enable the soil to subside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm below the adjoining ground level or as directed by the Engineer-in-charge.

22.9.1.2 Measurements: Holes shall be enumerated.

22.9.2 In Soil other than Ordinary Soil

22.9.2.1 Where holes are dug in (a) Hard soil (b) Ordinary rock or (c) Hard rock, the different excavated soil shall be stacked separately. Excavation in hard rock shall be carried out by chiseling only.

22.9.2.2 The stack measurement of ordinary rock and hard rock shall be reduced by 50% and of soil by 20% to arrive at the excavated volume.

22.9.2.3 The ordinary soil excavated from the hole and the earth brought from outside shall then be mixed with manure screened through sieve of IS designation 16 mm in the proportion specified in the description of the item and filled with the pit and the same watered and finally dressed.

22.9.2.4 Measurements: The pit shall be enumerated. The volume of excavation in soil and other than a ordinary soil shall be determined by reducing the stack volume of the relevant soil with respective percentage for voids specified in Chapter-23 of CPWD specifications VOL-II,2009.

22.10 M.S. FLAT IRON TREE GUARD

22.10.1 M.S. Iron Riveted Tree Guard

22.10.1.1 The tree guard shall be 600 mm in diameter and 2 meter high above ground level and 25 cm in below ground level.

22.10.1.2 The tree guard shall be framed of 4 nos. 25 x 6 m M.S. flat 2 meter long excluding displayed outward at lower and upto an extent 10 cm and 8 nos. 25 x 3 mm vertical M.S. Flat Rivetted to 3 Nos. 25 x 6 mm Flat iron rings in two halves, bolted together 8 mm dia and 30 mm long M.S. bolts and nuts. The entire tree guard

shall be given two coats of synthetic enamel paint of approved brand and manufacturer of required shade over a priming coat of ready mixed steel primer of approved brand and manufacturer.

22.10.1.3 Measurement: The tree guard shall be enumerated.

22.10.2 M.S. Flat Iron Welded Tree Guard

22.10.2.1 The tree guard shall be 600 mm in diameter and 2 meter high above ground level and 25 cm in below ground level.

22.10.2.2 The tree guard shall be framed of 4 nos. 25 x 6 mm MS. Flat 2 metres long excluding displayed outward at lower and upto an extent 10 cm and 8 Nos. 25 x 3 mm vertical M.S. Flat Riveted to 3 nos. 25 x 6 mm flat iron rings in two halves, bolted together 8 mm dia and 30 mm long M.S. Bolts & nuts. The entire tree guard shall be given two coats of synthetic enamel paint of approved brand and manufacturer of required shade brand and manufacturer of required shade over a priming coat of ready mixed steel primer of approved brand and manufacturer

22.10.2.3 Measurement: The tree guard shall be enumerated

23. Detailed Specification for Ceiling Fan

Schedule 1 Electric Ceiling Fan Capacitor Type

1. Electric ceiling fans shall be capacitor type, with double ball bearing complete with capacitor, 300 mm down rod, canopies, three number blades made of aluminium alloy, with suitable speed regulator, suitable for operation on single phase AC 230 volt, 50 Hz supply and shall conform to class 1 of IS: 374/1979 (Reaffirmed 2005).
2. Wherever applicable, the ceiling fan shall be ISI marked and/or have BEE 5 star marking.
3. The electronic regulators (step type) shall conform to IS: 374/1979 (Reaffirmed 2005).
4. The resistance type regulator shall confirm to IS:374/1979 (Reaffirmed 2005).

IMPORTANT NOTE:

Ceiling fan with 1200 mm and 1400 mm sweep having ISI mark and BEE 5 star rating shall ONLY be accepted. Further, only electronic regulators (step-type) shall be accepted. As such, item numbers 2,3,4,5,7,8,9,10 & 11 of schedule -1 shall stand DELETED in rate contract for year 2012-13. Hence, it is in the interest of the firms to get their products type tested as per relevant specifications of BIS and BEE 5 star rating and get them registered with DGS&D, well in advance.

24. SPECIFICATIONS FOR LED TUBE LIGHT LED Tube Light's Features:

AIuminium heat sink, No UV or RF interference, heat sink with or without optical diffuser, longer life than incandescent & fluorescents. No mercury, no ballast required, wide voltage input range and constant current design, solid state, high shock & vibration resistant, Mercury free, 66%+ savings in energy consumption, quiet, no noise, no flickering. The products are in accordance with CE, UL and FCC testing standards, Retro-fit kits available for direct replacement of fluorescent fixture.

1. LED Tube Light - 4 Foot

Wattage: 15W

Working Voltage: AC 100V-277V ACDC 12V

Lumens: Frost cover (WW/NW/DW/CW) 1200/1300/1500/1400LM

Clear cover (WW/NW/DW/CW) 1350/1450/1650/1550LM
Central Lux: 60-120 Lux/3m CRI: (WW/NW) 70; (DW/CW) 80;
Diameter: T30mm T8, T10
Dimensions: 4 foot length (1200mm)
Lighting Angle: 60, 90-120,160 degree
Life Hours: 5 year more
LED Count: 300 LED's (DSP or SMD)
Housing temperature: Less than 35 deg C
Ambient Temperature: - 20~45'C

2. LED Tube Light - 2 Foot

Wattage: 8W
Working Voltage: AC 85V-265V ACDC 12V
Lumens: Frost cover (WW/NW/DW/CW) 700/750/800/750 LM
Clear cover (WW/NW/DW/CW) 780/830/890/830 LM
Central Lux: 60-120 Lux/3m CRI: (WW/NW) 70; (DW/CW) 80;
Diameter: 30mm T8, T10
Dimensions: 2 foot length (600 mm)
Lighting Angle: 60, 90-120, 160 degree
Life Hours: 5 year more
LED Count: 180 LED's (DSP or SMD)
Housing temperature: Less than 35 deg C
Ambient Temperature: - 20~45'C

3. LED Tube Light - 3 Foot

Wattage: 12W
Working Voltage: AC 85V-265V ACDC 12V
Lumens: Frost cover (WW/NW/DW/CW) 850/900/950/900 LM
Clear cover (WW/NW/DW/CW) 940/990/1050/990 LM
Central Lux: 60-120 Lux/3m CRI: (WW/NW) 70; (DW/CW) 80;
Diameter: T30mm T8, T10
Dimensions: 3 foot length (900 mm)
Lighting Angle: 60, 90-120, 160 degree
Life Hours: 5 year more
LED Count: 225 LED's (DSP or SMD)
Housing temperature: Less than 35 deg C
Ambient Temperature: - 20~45'C

25. SAFE DEPOSIT LOCKER CABINETS TYPES

- Safe deposit locker cabinets shall preferably be of the following types:

a) Type 1 – Containing 75 lockers,
b) Type 1A – Containing 90 lockers,
c) Type 2 – Containing 52 lockers,
d) Type 2A – Containing 51 lockers, and
e) Type 3 – Containing 32 lockers,
f) Type 4 – Any other configuration

- All cabinets of type 4 shall be c l early designated so as to indicate the number and combination of lockers. The designation shall be given in the following manner:

Type 4/total no. of lockers/ no of lockers of each size with their designations used in this specifications.

E.g, Cabinet with total 12 lockers, with 6 nos A - lockers, 3 nos 2A – lockers and 3 nos 4A - lockers shall be designated as Type 4/12/A-6 X 2A-3 X 4A-3

MATERIAL

Material used for manufacture of Safe Deposit Locker Cabinet shall be as specified in Table 1.

Table 1 Material for Manufacture of Components of Locker Cabinet

Sl. No.	Component	Material Thickness (Nominal), mm	Material Specification	Finish
i)	Sides, Top, Back	5	Any grade of steel with minimum tensile strength of 270 MPa	The inside and outside surfaces of the locker cabinet shall be painted or powder coated. In case of paint, an appropriate primer and undercoating shall be used in accordance to industry practices. The minimum overall thickness of the coatings shall be 50 microns for powder coating and 70 microns for liquid paint
ii)	Partitions, Shelves	2		
iii)	Bottom	3 (		
iv)	Door	10		
v)	Hinge / Axle	16 SQ		
vi)	Shelf Front	5		
vii)	Door Front (Fascia) (optional)	0.7	Stainless Steel or Al or Mild Steel	Al- anodised to 5 micron thickness or powder coated to 50 microns MS- Painted (70 microns) or powder coated (50 microns)

Note 1: Bottom can also be manufactured in 2 mm thick material with reinforcement of 2 mm thick stiffeners.

- **DESIGNS AND MANUFACTURE**
  - Lockers shall be secured with unpickable dual control key-lock or multi-row pin cylinder (MPC) lock or combination of MPC and lever type lock. They shall be self locking so that the custodian does not have to re-lock the locker with his (custodian's) key after the lessee has Iocked it. The mechanism of the lock shall be such that the lessee shall not be able to withdraw his key unless the locker has been re-locked fully. Once the lessee has locked the locker, the same cannot be opened unless the custodian turns in his key to take off his control. No key of one lock shall apply to any other lock except its own. The lessee's as well as the custodian's keys shall be made of stainless steel or any other metal / alloy having non – corrosive properties.
  - The manufacturer of safe deposit locker cabinets shall be an original equipment manufacturer of locks used in the cabinet. The key cutting and key permutation generation process shall be computerized. Outsourcing of the lock or key manufacturing process (except key blank manufacturing) shall not be permitted, either wholly or partially.

- The locks shall be interchangeable so that when a locker is vacated by a lessee, the lock may be and should be immediately transferred to another locker and vice versa.
- Provision shall be made to fit on the inside of the locker door another strong and unpickable lock of the lessee if so desired by the lessee. Third key hole of the renter's lock, when the lock is not fitted will be protected by a plate or by secure plug, making the inside of the locker inaccessible to access from the outside. An outside pad locking arrangement or hasp shall also be provided.
- The lock and the shutter arrangement shall be such that locking bolt of the lock projecting into locker or the locking hole, as the case may be, shall have sufficient protection against tampering with crow bar or other hand tools.
- Locking bolt of the lock shall be strong enough in both the directions of its section (that is, Ixx and Iyy) to provide resistance against bending.
- Locking bolt of the lock when lock is in locked position, shall have depth of engagement of not less than 5 mm.

➢ **WORKMANSHIP**

- All dents, burrs and sharp edges shall be removed from the various components and they shall be thoroughly degreased and cleaned of rust and scale preferably by sand blasting or by normal pickling process.
- **Tolerance:** Gap around the door plate on front, top and bottom shall not be more than 1 mm, if there is direct through passage. Wherever there is no direct through passage the gap shall be maximum 1.5 mm.
- Welded joints shall be free from weld defects and welding slags.

➢ **TESTING**

- The locker unit shall be tested for its performance against burglarious attacks with common hand tools such as spanners pliers, chisels, punches, hammers (not exceeding 1 kg in mass), crow bars (maximum 500 mm in length and 15 mm in diameter) and screw drivers. The locker units shall be able to withstand such attacks successfully for a period of not less than 3 minutes.
- Each locker unit shall be tested to ensure that the customer's key does not come out unless the shutter is completely closed and the lock is fully locked.

➢ **MARKING**

All the safe deposit locker cabinets shall be marked with the manufacturer's name or trade mark, the type and year of manufacture.

- **Certification Marking:** Safe deposit locker cabinets may also be marked with the Standard Mark. The lockers shall be serially numbered and marked on the outside of locker doors by the manufacturer as desired by the customer.

➢ **Marking on Keys**

The keys shall be marked with an identification number which shall not be the same as the serial number of the corresponding locker.

➢ **PACKING**

All the component parts shall be packed in such a way that no damage is caused to them during transit. The keys shall be sealed in a box/pouch and dispatched separately to the purchaser in person.

26. General Specifications for Signboard

The language/ script of the Signboard should be in English and uniform including **the colour pattern. The sample for the language of the script on the Board is as** per Annexure – A.

GENERAL SPECIFICATION

S. No	Components	Desired specifications
1.	Iron Sheet	MS-16 Gauge (1.6 mm)
2.	Size of Iron Sheet	4x3‘
3.	Painting on Board	Dually painted with Enamel paint with base coat of Red Oxide
4.	Painting on Board	Colour printing by screen printing method or equivalent
5.	Height of Board from Ground level	4 feet
6.	Height of Board from Ground level	4 feet
7.	Length of the angle to be inserted inside the ground	1.5 feet with 1 feet long hole pass
8.	Size of the Board	4‘ x 3‘

27. Specification for Trash Bins – Wheel Based

Wheeled Waste Bins (With Frame and Handle)

- Capacity: 50 Ltr, 80 Ltr; 100 Ltr, 120 Ltr, 150 Ltr. & 200 Ltr.

Products Specification:

- Designed by using high-grade LDPE/HDPE material, and glazed finish
- Easy operations with foot operated broad pedal, and this ensures minimum noise
- Reduced frequent opening with innovative pre-cut design
- Maintenance free lid open-easy shut
- Rectangular / oval shape front for good stability
- Push-type handle and two wheels of 3-4 A¢a,-,A diameter
- Available in Blue, Red, Yellow and Black colours
- Come with bio-hazard symbol and name of hospital is inscribed on bin

Products Specification:

DIMENSION (MM)	HEIGHT	LENGTH	WIDTH
50 LTR.	650	TOP-295, BOTTOM-243	TOP-295, BOTTOM-243
80 LTR.	665	TOP-353, BOTTOM-275	TOP-353, BOTTOM-275
100 LTR.	700	TOP-425, BOTTOM-350	TOP-425, BOTTOM-350
150 LTR.	885	TOP-505, BOTTOM-440	TOP-505, BOTTOM-440

Two Wheeler Bin

- **Capacity** 120 Ltr. & 240 Ltr.

Products Features:

- Made from top-grade HDPE / LDPE material and glazed finish
- Easy foot operated broad pedal with minimal noise
- Rectangular front for good stability
- Maintenance free lid, simple open-easy shut
- Available in Blue, Red, Yellow and Black colours
- Biohazard symbol on bin

- Push-type handle and two wheels of 3-4 A¢a,-,A diameter

Products Technical Specification:

DIMENSION (MM)	HEIGHT	LENGTH	WIDTH
120 LTR.	770	TOP-410, BOTTOM-350	TOP-425, BOTTOM-350
240 LTR.	995	TOP-535, BOTTOM-500	TOP-535, BOTTOM-500

28. Specifications for HIGH MAST SYSTEM

DETAILED TECHNICAL DATA SHEET FOR 20 MTRS. HIGH MAST SYSTEM

HIGH MAST STRUCTURE		
Height of Mast	:	20 Mtrs
Material of construction	:	S355 Grade as per BS-EN 10025
Thickness in mm	:	Top – 3 mm; Bottom – 4 mm
Cross section of mast in Polygon (No. of sides)	:	20 sides (min)
No. of section and Length of individual section	:	In Two sections, Bottom – 10.88 Mtr (app) Top – 9.42 Mtrs (app)
Base and Top diameter	:	Top Dia. – 150 mm (Min) Bottom Dia. – 460 mm (Min)
Type of Joints	:	Stress fit side joints
Length of overlap	:	0.40 to 0.5 Mtrs
Metal protection treatment	:	HOT DIP GALVANIZED THROUGH
Thickness of Galvanization	:	65 micron (min) as per IS EN ISO1461
Base opening and door size	:	1200 mm x 250 mm
Type of blocking arrangement And door panel	:	Double Internal
Details of slack board inside the Base compartment	:	PVC board 200 mm x 500 mm
Terminal box power control	:	Sheet metal box of suitable size in 2 mm thick to accommodate required MCBs.
Thickness of base plate	:	25 mm
Size of anchor plate & Thickness	:	Uniform pitch circle dia. of 590 mm
Details of Template	:	Uniform pitch circle dia. 590 mm
Weight of mast in Kgs	:	550 Kgs (min) (without accessories)
Lighting protection finial	:	G.I. single spike of length 1200 mm
Make of Mast	:	BAJAJ / GE POWER / PHILIPS / TRANSRAIL LIGHTING
		(TEST TO BE CARRIED OUT AT OEM END / FACTORY)

DYNAMIC LOADING AS PER PREVAILING AT SITE :		
Max. wind speed	:	44 m/s as per IS 875 Part III
Max. gust speed time	:	3 seconds
Height above ground level (These above two levels are measured)	:	10 Mtrs.
Factor of Safety for wind	:	1.25
load		
Factor of Safety for other	:	1.15 (as per TR No. 7)
		(Test Report shall be produced)
FOUNDATION DETAILS		
Type of foundation	:	Open Raft Shallow Footing
Size of foundation	:	As per Manufacturer‘s design
Designed Load Bearing capacity	:	10 T per sq.m at 2 Mtrs. depth
Design Safety Factor	:	As per IS 456
Considered W ind	:	As per IS : 875 - 1987
Considered W ind speed	:	As per IS : 875 - 1987
Depth of Foundation	:	Max. 1.5 M below Ground level
Average Soil bearing capacity	:	As per site requirement
Number of foundation bolts	:	8 Nos.
PCD of foundation bolts	:	590 mm
Type of foundation bolts	:	TS 600 / 30 mm dia / 850 mm
Bolt diameter	:	30 mm
		(Test report shall be produced)
LANTERN CARRIAGE		
Material of construction	:	50 NB ERW class B – MS Pipe
Diameter of carriage ring	:	710 mm (ID) (Min)
Construction	:	To suit Lighting Design
No. of joints	:	Two Nos.
Buffer arrangement between	:	PVC sleeve on carriage
Load carrying capacity	:	500 kg
Total weight of assembly with	:	As per nos. of Luminaries
No. of Fittings	:	12 Nos. of 2x400 W MH
		(Test report shall be produced)
W INCH		
Material of winch	:	GE power / Bajaj / Transrail Lighting
Number of drums / winch	:	Double drum type
Gear ratio	:	53 : 1
Capacity	:	500 Kg.
Method of operation	:	Integral Motor
Lubrication arrangement	:	Permanent oil bath
Type of Lubricant	:	SAE 140 / SAE 90
Tested load per drum	:	1500 Kg. for winch

		(Test report shall be produced)
STAINLESS STEEL W IRE		
Make	:	B.W. Ltd / SAFE LIFT ENGG
Grade	:	AISI 316
Number of ropes	:	Two continuous
Construction	:	7/ 19
Center core material	:	Stainless steel core
Diameter (mm)	:	6 mm
Thimble & Talurit	:	SS Thimble
Breaking load capacity	:	Min 2400 Kg. x 2
Safety Factor	:	> 5 for system at full load
		(Test report shall be produced)
CABLE		
Type	:	Trailing cable
Material	:	Copper Conductor EPR insulated
No. of core	:	5 core, 4.0 sq. mm
No. of circuit per Mast	:	One
Current carrying capacity	:	30 Amps
		(Test report shall be produced)
POW ER TOOLS		
Model	:	Integral / Gear motor
Input supply	:	3 phase, 415 +/- 10% volts, 50 Hz, AC
W attage / HP	:	Min. 1 HP & above if required
Number of speed	:	6 pole, single speed, 410 RPM
Operating Speed	:	2 M / minute
Remote control switch	:	Pendent Switch
Make	:	GE Power / Crompton / Kirloskar
		(Test report shall be produced)
TORQUE LIMITOR		
Lifting capacity	:	Up 750 Kg
Adjustable / Non - Adjustable	:	Adjustable
Tripping device	:	Mechanical
		(Test report shall be produced)
LUMINARIES & CONTROL		
Type	:	Non – Integral, Outdoor purpose, Aluminium die
Quantity	:	12 Nos.
Make	:	PHILIPS / GE POWER / BAJAJ / CROMPTON
		GREAVES / WIPRO are only acceptable.
		(Test report shall be produced)
Control system	:	Shall be controlled through a programmable timer
EARTHING & LIGHTING		
Earthing	:	Suitable size earth termination shall be provided to
No. of connection	:	Two.

Lighting protection	:	Shall be incorporated and the final shall be fitted in
Final length	:	1200 mm
AVIATION LIGHTING		
Aviation light	:	One set of Aviation caution light shall be provided in
GENERAL		
The Mast, Foundation and electrical drawing should be approved before commencement of work		
All safety measures shall be adopted while execute (E&C) the work		
GUARANTY & WARRANTY		
One year GUARANTY & WARRANTY certificate shall be provided by the Manufacturer of Mast and free service for first year shall be provided as when required for attending the breakdown in the system / winch etc.		
After guaranty period service support shall be rendered by the Manufacturer of high mast.		

29. Weep Holes

29.1 Weep holes shall conform to **Clause 2706** of MoST Specifications for Road and Bridge Works (IV Revision).

Filter media

The material for the filter shall consist of sand, gravel, stone or coarse sand. To prevent escape of the embankment material through the voids the stone pitching / cement concrete blocks as well as to allow free movement of water without creating any uplift head on the pitching, one or more layers of graded materials, commonly known as a filter medium, shall be provided underneath the pitching.

The gradation of the filter material shall satisfy the following requirements: Provision of a suitably designed filter is necessary under the slope pitching to prevent the escape of underlying embankment material through the voids of stone pitching/cement concrete blocks when subjected to the attack of flowing water and wave action, etc. In order to achieve this requirement, the filter may be provided in one or more layers satisfying the following criteria:

- Ratio of D 15 (Filter) to D 85 (Base) shall be less than 5;
- Ratio of D 15 (Filter) to D 15 (Base) shall be within the limits of 4 and 20; and
- Ratio of D 50 (Filter) to D 50 (Base) shall be less than 25;

Notes:

1. *Filter design may not be required if embankment consists of CH or Ch soils with liquid limit greater than 30, resistant to surface erosion. In this case, if a layer of material is used as bedding for pitching, it shall be well graded and its D 85 size shall be at least twice the maximum void size in pitching.*
2. *In the foregoing, D 15 means the size of that sieve which allows 15 per cent by weight of the filter material to pass through it and similar is the meaning of D 50 and D 85.*

3. *If more than one filter layer is required, the same requirement as above shall be followed for each layer. The finer filter shall be considered as abase material for selection of coarser filter.*
4. *The filter shall be compacted to a firm condition. The thickness of filter is generally of the order of 200 mm to 300 mm. Where filter is provided in two layers, thickness of each layer shall be 150 mm*.

Construction Operations

Before laying the pitching, the sides of banks shall be trimmed to the required slope and profiles put up by means of line and pegs at intervals of 3 metres to ensure regular straight work and a uniform slope throughout. Depressions shall be filled and thoroughly compacted.

The filter granular material shall be laid over the prepared base and suitably compacted to the thickness specified on the Drawings.

The lowest course of pitching shall be started from the toe wall and built up in courses upwards. The toe wall shall be in dry rubble masonry (uncoursed) in case of dry rubble pitching and shall be in nominal mix cement concrete (M 15) in case of cement concrete block pitching.

The stone pitching shall commence in a trench below the tow of the slope. Stone shall be placed by derrick or by hand to the required length, thickness and depth conforming to the Drawings. Stones shall be set normal to the slope, and placed so that the largest dimension is perpendicular to the face of the slope, unless such dimension is greater than the specified thickness of pitching.

The largest stones shall be placed in the bottom courses and for use as headers for subsequent courses.

In hand placed pitching, the stone of flat stratified nature should be placed with the joints are broken and voids are minimum by packing with spalls, wherever necessary, and the top surface is as smooth as possible.

When full depth of pitching can be formed with a single stone, the stones shall be laid breaking joints and all interstices between adjacent stones shall be filled in with spalls of the proper size and wedged in with hammers to ensure tight packing.

When two or more layers of stones must be laid to obtain the design thickness of pitching, dry masonry shall be used and stones shall be well bonded. To ensure regular and orderly disposition of the full intended quantity of stone as shown, template cross walls in dry masonry shall be built about a metre wide and to the full height of the specified thickness at suitable intervals and all along the length and width of the pitching. Within these walls the stones shall be hand packed as specified.

30. Vent Shafts

Vent shafts shall be erected at places shown on the Drawings of longitudinal sections of the sewers or as directed by Engineer.

RCC Vent Shafts: RCC vent shaft shall be of 100 mm Ø and 6.0 m height from ground level with inside core 150 X 150 at top & 200 X 200 at bottom in PCC M150 foundation including flue chamber in brick masonry CM 1:4 with 20 mm thick cement plastering CM 1:3. This shall be connected to the nearest manhole shaft by 150 mm diameter GSW pipe or as directed by Engineer.

Jointing of Stoneware Pipe: The spigot and socket joints of stoneware pipes shall be of rigid type and shall be caulked with tarred gasket (prepared ready for use before being brought on the work in one length for each joint and sufficiently long to entirely surround the spigot end of the pipe. The gasket to be driven as far as possible by means of a suitable instruments. After the pipes area thoroughly cleaned and moistened, mixture of one part of cement and one part of clean fine sand tempered with just sufficient water to have a consistency of semi-dry condition should be forced into the joint and well rammed with caulking tools, so that whole space around the spigot and socket is completely filled with lightly chalked mortar and the joints shall be finished off with a splayed fillet sloping at 5 degrees to the side of the pipe

Measurement for Vent Shaft: The rate quoted in Schedule of Quantities and Rates for Vent shaft shall be deemed to include the cost of RCC vent shaft, necessary excavation to manhole inclusive of concrete encasement, erecting, etc. complete. The measurement for vent shaft shall be on per number basis.

31. Ductile Iron Pipes

The pipes will be centrifugally cast (spun) Ductile Iron pipes for Water and Sewage confirming to the IS 8329: 2000. The pipes used will be either with push on joints (Rubber Gasket Joints) or Flanged joints. The class of pipe to be used shall be of the class K-9.

The pipes shall be coated with bitumen as per appendix C and have factory provided cement mortar lining in the inside as per the provisions of Appendix B of the IS 8329: 2000. The pipes will be supplied in standard length of 4.00, 5.00, 5.50 and 6.00 meters length with suitably rounded or chamfered ends. Each pipe of the push on joint variety will also be supplied with a rubber EPDM/(SBR) gasket. Any change in the stipulated lengths will be approved by the Engineer – in charge. The gaskets will confirm to the IS 5382:1985.

The gaskets should also be supplied by the manufacturer of the pipes. They should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the manufacturer of the pipes to have them manufactured from a suitable manufacturer under it‘s own supervision and have it tested at his/sub contractors premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products.

The flanged joints will confirm to the Clause 6.2 of IS 8329. The pipe supply will also include one rubber gaskets for each flange.

Inspection and Testing: The pipes will be subjected to following tests for acceptance:

- Visual and dimensional check as per Clause 13 and 15 of IS 8329

- Mechanical Test as per Clause 10 of IS 8329
- Hydrostatic Test as per Clause 11 of IS 8329
- The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5832 and will be in accordance to **Clause 3.8**

The sampling shall be as per the provisions of the IS 8329

Marking

- All pipes will be marked as per Clause 18 of IS 8329 and show as below:
- Manufacturer name/ stamp
- Nominal diameter
- Class reference
- A white ring line showing length of insertion at spigot end

Packing and Transport: The pipes should be preferably transported by road from the factory and stored as per the manufacturer specifications to protect damage.

Specials for Ductile Iron Pipes

This section covers the general requirements for Ductile Iron (DI) fittings suitable for Tyton joints to be used with Ductile Iron pipes with flanged and Tyton jointing system.

Types of specials: The following types of DI fittings shall be manufactured and tested in accordance with IS:9523 or BS: 4772.

- flanged socket
- flanged spigot
- double socket bends (900, 450, 22 1/2 0, 11 1/4 0)
- double socket branch flanged tee
- all socket tee
- double socket taper
- All the fittings shall be of class K-12.

Supply: All the DI fittings shall be supplied with one rubber ring for each socket. The rubber ring shall conform to IS: 12820 and IS: 5382 as described in the preceding chapter. Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

Lubricant for ductile iron pipes and specials: This section covers the requirements for lubricant for the assembly of Ductile Iron pipes and specials suitable for Tyton push-in rubber ring joints

Specification: The lubricant has to have the following characteristics:

- must have a paste like consistency and be ready for use
- has to adhere to wet and dry surfaces of DI pipes and rubber rings
- to be applied in hot and cold weather; ambient temperature 0 - 50°C,temperature of
- exposed pipes up to 70 °C
- must be non toxic
- must be water soluble
- must not affect the properties of the drinking water carried in the pipes
- must not have an objectionable odour
- has to inhibit bacterial growth
- must not be harmful to the skin

- must have a shelf live not less than 2 years
- Acceptance tests
- They shall be conducted in line with the provisions of the IS 9523

Packing: All the DI fittings shall be properly packed with jute cloth. Rubber rings shall be packed in polyethylene bags. Rubber rings in PE bags and nuts, bolts etc. shall be supplied in separate jute bags.

The fittings should also be supplied by the manufacturer of the pipes. They should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the manufacturer of the pipes to have them manufactured from a suitable manufacturer under its own supervision and have it tested at his/sub-contractors premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products

Bedding of the pipes

The trench bottom shall be even and smooth so as to provide a proper support for the pipe over its entire length, and shall be free from stones, lumps, roots and other hard objects that may injure the pipe or coating. Holes shall be dug in the trench bottom to accommodate sockets so as to ensure continuous contact between the trench and the entire pipe barrel between socket holes.

32. DIESEL GENERATOR SETS

The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary control panel, battery, diesel tank etc and accessories to provide prime electric power for the duration of any failure of the normal AC source.

STANDARDS

The equipment offered shall conform to the latest revision of relevant Indian or British Standard (BSS) as indicated below and Codes together with the requirements of the Local Supply Authority. Engine shall conform to BS 5514/IS:10000 and the alternator shall be in accordance with IS:4722/BS:2613/IEC-34(Part-1).

33. ENGINE AND ACCESSORIES:

33.1 DIESEL ENGINE: Diesel Engine of required bhp, stationary type, four stroke with V cylinder arrangement shall be complete with integral air intake through suitable air filters and exhaust system, speed regulation system, fuel injection system, lube oil system, cooling water system, silencers, self contained piping, instruments, mounted on anti-vibration mounts

The engine shall have the following characteristics:

Type	-	Suitable for generating set application, turbo charged, multicylinder, 4- stroke, cold starting.
Cycle	-	Four stroke
Speed	-	1,500 r.p.m.
Method of Starting	-	Battery
Net site output	-	This shall be the prime power output (exclusive of the power requirements of auxiliaries deriving power with engines) at 1500 r.p.m. under site conditions.

Overload feature	-	The engine shall have 10% overload capacity for one hour in every 12 hours of operation.

-

Engine rating shall be stated in the tender in accordance with the standards above. The engine should comply to CPCB emission guidelines and should be of emission optimized type. The engine shall be installed in area where in it need be operated for long durations. Bidder need to declare the max load factor for prime power continuous duty application.

ACCESSORIES:

EXHAUST SYSTEM:

Turbocharger
Silencers – residential type
Stainless Steel Flexible Bellows.

COOLING SYSTEM:

- Heat Exchanger
- Cooling water centrifugal pump
- Bypass Thermostat

FUEL SYSTEM:

- Fuel pump
- Fuel injectors
- Fuel filter
- Fuel hoses
- Lube oil pump
- Lube oil-priming pump.
- Lube oil filter
- Bypass filter

INTAKE AIR SYSTEM:

- Air intake manifold
- Air cleaner
- Vacuum indicator
- GOVERNOR :
- Electronic EFC
- Starting System
- 24 V DC Electric starter
- Battery Charging Alternator

LUBE OIL SYSTEM:

COUPLING ARRANGEMENT

- Flexible coupling
- Flywheel to suit flexible coupling
- Flywheel housing

PROTECTION / WARNING

- Engine:
- Over Speed Shutdown
- Low Lube Oil Pressure Warning /Shutdown
- High Coolant Temperature Warning / Shutdown
- Low Coolant Level Warning / Shutdown
- Low Coolant Temperature Warning

- Low And High Battery Voltage Warning
- Weak Battery Warning
- Dead Battery Shutdown
- Over Crank Shutdown
- Fail To Crank Shutdown

33.2 Fuel Consumption

The engine shall be suitable for satisfactory operation on H.S.D. as locally available.

33.3 Lubricating Oil Consumption

The tenderers shall state the lubricating oil consumption in gm/bhp-hr (ltr/hr) at rated load.

33.4 Governing

The governor shall be Electronic type confirming to Class A1 and shall be a self contained unit capable of monitoring speed.

33.5 Frequency Variation :

The engine speed shall be so maintained that frequency variation at constant load including no load shall remain within band of 1% of rated frequency.

33 .6 Mounting and Foundations

The engine and direct coupled alternators shall be rigidly secured to common rigid base frames fabricated from MS sections. The DG set shall be placed on concrete block with anti vibration mountings.

33.7 Exhaust Piping

33.8 Exhaust System

Each engine shall be provided with residential type silencers so as to limit the sound level from the DG set.

Exhaust piping shall be fabricated from Class ‗C' MS Black Pipe conforming to relevant IS standard size suitable to limit back pressure to within permissible limit. The exhaust shall be terminated as per pollution norms. Exhaust piping inside DG room shall be insulated with 75 mm thick mineral wool and 26 gauge Al. cladding. Exhaust piping shall be connected to the engine by means of flexible section or an expansion joint.

33.9 Turbocharger

Turbocharger mounted at the side of the engine for better conversion of energy of exhaust gases resulting in more power, improved fuel economy, altitude compensation, lower exhaust temperature, lower smoke and noise level

33.10 Air Filter

The engine air intake shall be fitted with dry type air cleaner with vacuum indicator facilitating change of air filter.

33.11 Fuel And Lubricating Oil Filters

Filter for fuel and lubricating oil systems shall be of replaceable paper element type.

33.12 Lubricating Oil System

The engine shall be of the totally enclosed type and fitted with a positive pressure system of lubrication to all working parts. Lubricating oil shall be circulated in the engine by an engine driven pump. There shall be no moving part requiring lubrication by hand prior to the starting of the engine or while in operation. It shall be so designed that when the engine starts after a long shut down lubrication failure does not occur. Necessary priming pump for the lub oil circuit shall be installed to keep bearings primed.

33.13 Safety Controls

Low Lubricating Oil Pressure

Pressure sensors shall be fitted such that in the event of a fall in the lub oil pressure and indication shall be actuated. In addition, the engine shall be automatically shut down in the event of lub oil pressure dropping to a pre-determined low value.

High Water Temperature

An indication shall be given if the water temperature exceeds the safe limits and the shall be shut down when a pre-determined set water temperature is reached.

Over Speed

Speed control shall be so arranged that 12-13% increase over normal rated speed shall cut off fuel supply, thus stopping the engine.

33.14 General

The DG sets shall be complete with all equipments, indications and controls required for fully reliable and safe operation of the DG sets whether specifically stated in these specifications or not. It is essential that the operation of all protection equipments be completely reliable in all respects.

33.15 Engine Mounted Instruments Panel (Electronic): The flexibly mounted instrument panel on engine shall be complete with the following:

33.15.1 Digital Display to indicate :

- Coolant Temperature
- Lub Oil Pressure
- Battery voltage
- Engine speed
- Engine Run hours

34 GENERATOR:

Synchronous alternator of suitable capacity to generate 1010 KVA output at alternator terminal at 415 V, 50 Hz, 3 Phase, 4 Wire, 0.8 pf (lag) 1500 RPM and in accordance with BS:2613 / IS:4722/IEC- 34(Part-I) shall be of totally enclosed or screen protected dip proof and self air-cooled type driven by the Diesel Engine. Generator shall be supplied along with its excitation system, AVR and include all necessary auxiliaries.

A Generator / Alternator shall have following characteristics:

- Permissible voltage regulation (max.) in static condition + 0.5% Permissible over load of 10% for one hour in every 12 hrs. of operation

- Permissible voltage & frequency variation of + 0.5% & + 1 % respectively
- Alternator shall be provided with QDCTs, RTD & BTD.

B Excitation System:

The Generator shall be provided with brush less excitation system capable of supplying the excitation current of the generator under all conditions of output from no load to full load.

C Enclosure:

Alternator enclosure shall be Screen Protected Drip Proof (SPDP) conforming to IP-23.

D Winding: Class 'H'Insulation shall be used for stator/rotor winding.

E BATTERY:

Battery of voltage and capacity compatible with the engine, complete with battery charging equipment shall be provided to energise electric starting equipment. Batteries shall be of lead-acid automotive type. The charging unit shall be part of existing DG control panel.

35. DG TESTING:

TESTS AT MANUFACTURER'S WORK

The following tests shall be performed at manufacture's works prior to packing and dispatch to site, in the presence of Project Manager/Consultant. A week's notice shall be given. Nothing extra shall be payable. If witness is waived off the contractor shall have to submit test certificate.

On DG Set

a. Maximum power load capacity.
b. Maximum motor starting capacity c. Endurance test.
d. Fuel consumption at full load, 50% load, 75% load and 25% load.

On The Alternator

a. High voltage tests on stator and rotor windings.
b. Insulation resistance of stator and rotor windings. c. Temperature rise test.
d. Stator voltage and current tests.
e. Stator phase sequence check.

On The Exciter

a. High voltage tests on stator and rotor winding.
b. Insulation resistance of stator and rotor windings. c. Temperature rise test.
d. Measurement of losses.

On The Automatic Voltage Regulator

a. Sensitivity test.
b. Response time test.

All routine test as per IS/BS codes shall be conducted on alternator, exciter and AVR. Moreover the engine and alternator supplied shall be duly tested and supported by the test certificates of the respective manufacturer.

TECHNICAL SPECIFICATIONS OF ACOUSTIC ENCLOSURE

- Silent DG Set container is of modular construction with the provision to assemble and dismantle easily at site.
- The enclosure is fabricated out of CRCA sheet of 14 SWG.
- The sheet metal components are hot dipped seven tank pre-treated.
- Enclosure is polyester based powder coated (inside as well outside).
- Nut, bolts & hardwares are Zinc coated.
- The doors are gasketed with EPDM gaskets to avoid leakage of sound.
- The door handles are lockable type.
- Sound proofing of enclosure is done with high quality rock wool/mineral wool confirming to IS 8183, of 100 mm thickness and density at 64 Kg/M3.
- The rock wool is further covered with fibre glass cloth and perforated powder coated m.s.sheet.
- Specially designed attenuators are provided to control sound at air entry to the container and exit from the container.
- Adequate ventilation is provided to meet air requirement for combustion and heat removal.
- Temperature of enclosure does not exceed beyond 5-7°C of ambient temp.
- The sound insertion loss shall be as per CPCB prescribed norms applicable presently.

36. DG AUXILIARY PANEL

CODES AND STANDARDS AND APPLICABLE PUBLICATION

415V Switchboard shall conform to latest applicable IS, IEC standard as listed below and other relevant standards / code as applicable.

IS : 13947 (Part – I to V)	:	Specification for low-voltage switchgear.
IS : 1248	:	Electrical measuring instruments and their accessories.
IS : 8623	:	Specification for low-voltage switchgear and Control gear assembles.
IS : 3072	:	Code of practice for installation and maintenance of switchgear.
IS : 2705 (Part – I to IV)	:	Current Transformers
IEC	:	61643-12 : Surge Protection Devices for Power Lines.
IEC : 60947-7-1	:	Terminal Blocks

GENERAL

The L.T. panel shall comprise the following type of switchgear as specified. The panel shall be capable of fault withstand capacity of 50 KA for duration of one second.

The panel shall be metal enclosed, indoor type having sectionalisation of incoming, and outgoing switchgears as specified. The design shall be cubicle type as specified.

The panel shall be floor mounted free standing totally enclosed and extensible type. The panel shall be with lockable arrangement with degree of protection IP - 54 and shall be suitable for the climate conditions as specified. The design shall include all provisions for safety of operating and maintenance personnel.

CONSTRUCTION

The panel shall be shall be fabricated out of CRCA sheet steel 2.0 mm thick. Wherever necessary, such sheet steel member shall be stiffened by angle iron frame work. General construction shall employ the principle of compartmentalization and segregation for each circuit. Unless otherwise approved, incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders. Each section of the rear accessible type board shall have hinged access doors at the rear. Overall height of the board shall not exceed 2.40 meters. Operating levers, handle etc. of highest unit shall not be at a height more than 1.8 m, and that of the lowest unit shall not be less than 300 mm above finished floor level. Multi-tier mounting of feeders is permissible. The general arrangement for multi-tier construction shall be such that the horizontal tiers formed present a pleasing and asthetic look. The general arrangement shall be got approved before fabrication.

Cable entries for various feeders shall be either rear or from the front through cable alleys located in between two sections of minimum 300 mm width. There shall be separate gland plate for each cable entry so that there will not be dislocation of already wired circuit when new feeders are added. Cable entry plates shall therefore be sectionalized. The construction shall include necessary cable supports for clamping the cable in the cable alley or in rear cable chamber. All cable entries shall be from the top/bottom as specified. Gland plate shall be minimum 3 mm thick.

Cable Termination / Bus Duct Terminations :

Panel shall be design for cable entry from bottom / top as required. Sufficient space shall be provided for each of termination and connection. All provision and accessories shall be furnish for termination and connection of power cables as per cable schedule including removal gland plates, copper / aluminums lugs, double compression brass glands with tapped washer and terminal blocks. Bus Duct connection shall be from the top. All provision for Bus Duct connection with accessories shall be provided.

Instruments

All meters shall be Digital type flush mounted type conforming to class 1.0 for accuracy and of size of 144 mm2 for incoming feeders and & 96 mm2 for outgoing feeders.

Indicator Lamps

ON/OFF and phase indicator lamps shall be provided suitable for operation on AC 230 Volts supply. Necessary filter G/Y/R/A shall be provided depending upon the function. All lamps shall be protected by proper HRC fuses. All lamps shall be LED type.

Wiring

All wiring controls, indication etc. shall be with minimum 2.5 sq. mm suitable stranded copper conductor cables PVC insulated. Wiring shall be suitably protected within the switchboard. Runs of wires shall be neatly bunched and suitably supported and clamped.

Means shall be provided for easy identification of the wires. Identification ferrules shall be used at both ends of the wires. All control wiring meant for external connection are

to be brought out on terminal board. Brass/Copper thinbles, insulation tape etc. shall be provided at joints & terminations as required.

Terminal Blocks

i. All control terminal blocks shall be unbreakable and IP 20 compliant. The metal parts of the terminal block including the captive screw shall be of Cu. Alloy and its housing shall be Polyamide class V0/V2 as per UL94. It shall be suitable for mounting on both C&G type rail and shall be capable to withstand vibration level upto 5g.

ii High current carrying terminal blocks suitable for 25-240 sq. mm wire shall contain individual terminal sleeve cover on each termination which is also individually separatable, to avoid accidental touch. It housing material shall be Polyamide as per UL 94 and shall be separated from each other by separating/partitionplate.

Bus Bar & Bus Bar Chambers

i. Bus Bar and Connections

a. The bus bar shall be of high conductivity Aluminium alloy of E 91 grade and of adequate section. The bus bar system shall comprise a system of totally enclosed main horizontal bus bars run at the top and vertical bus bars serving all modules in vertical section on either side in cable entries. In case of rear access, horizontal bus system shall run suitably either at the top or bottom. All connections to individual circuits from the bus bar shall be with solid connections. All horizontal bus bar, vertical bus bar and connections shall be suitably sleeved with PVC sleeves or suitably insulated in an approved manner.

b. The bus bar temperature should not exceed 90oC i.e. 40 ^{o}C temperature rise over 50^{o}C ambient. The calculation for temperature rise and bus bar sizing should be furnished along with shop drawing for approval.

c. Wherever copper bus bar and Aluminium bus bar are connected to each other, bimetallic strip shall be used.

ii. Bus Bar Supports and Attachments

Bus bar shall be firmly fixed on supports constructed from SMC (glass fibre reinforced thermosetting plastic). The supports shall be sufficiently robust to effectively withstand electro-mechanical stresses produced in the event of short circuit.

iii. Connection to Bus Bars

Connections to bus bars shall be made with bolts and nuts. Holes drilled into the bus bars may be made.The bolts and nuts used for connections to bus bars shall be of Aluminium alloy, tinned forged brass or galvanised iron. Suitable precaution shall be taken against heating due to bi-metallic contact. Further for tapping off connections from bus bars, PVC insulated wire may be used for current capacities upto 100 amps and for higher current capacities solid conductors/strips suitably insulated with PVC sleeves/tape shall be used.

iv. Clearances

The minimum clearances to be maintained for open and closed indoor air insulated bus bars/electrically non-exposed and working at system voltages upto 600 volts shall be as follows:

Between .....Minimum Clearances

Phase to Earth ..... 20 mm

Phase to Phase ..... 25 mm

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v. Bus Bar Markings

The colours and letters (or symbols) for bus bars :

Main bus bar connections and auxilliary wiring etc. shall conform to relevant Indian Standard. A brief from I.S. 375 (revised) is given below:

For AC bus bars and Main connections

S.No.	Bus Bar & Main Connection	Colour	Letter/Symbol
1.	Three Phase	Red, Yellow, Blue.	R,Y,B.
2.	Two Phase	Red, Blue	R,B
3.	Single Phase	Red	R
4.	Neutral Connection	Black	N
5.	Connection to earth	Green	E
6.	Phase variable (Such as connections to reversible motors)	Grey	Gy.

vi Phase Sequence and Polarity

Bus bars and main connections, when marked shall be marked in accordance with the following table to indicate the order in which the voltages in phases reach their maximum values.

System	As indicated by Colours or letters Vectorially	Phase sequence as indicated
Three Phase	Red, Yellow, Blue	R, Y, B.
Two Phase	Red, Blue	R, B.

vii. Arrangement of Bus bars & Main Connections:

Bus bars and main connections which are substantially in one plane shall be arranged in order given as follows :

a. A.C. System

i The order of phase connections shall be Red, Yellow and Blue.

ii When the run of the conductors is horizontal, the red shall be on the top or farthest away from the centre line as viewed from the front.

iii When the run of the conductor is vertical, the red shall be on the extreme left.

iv When the system has a neutral connection in the same plane as the phase connections, the neutral shall occupy an outer position.

v Unless the neutral connections can be readily distinguished from the phase connections, the order shall be red, yellow, blue and black.

b. Terminations

Incoming terminals shall be suitable for receiving cables.

36.1 PROTECTIVE DEVICES

Suitable Surge Protection Devices shall be provided at the input of Panel, conforming to IEC-61643-12 (Stage-I/Class B). The device shall be mountable on standard DIN Rail. It shall have the capability to arrest external lighting surges (of 10/350 µ waveform) up to 50 A between Line to Neutral & 100 KA between neutral to earth. The wiring shall be as per TT configuration of wiring.

Protective devices shall be provided as specified in the schedule of quantities. There shall be not less than 4 N/O and 4 N/C auxiliary contacts rated 5 amp on each breaker. The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall close before the main contacts have closed. All other contacts shall close simultaneously with the main contacts. The auxiliary contacts in the trip circuits shall open after the main contacts open.All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The heat generated in the contacts due to tripping under fault conditions shall be very nominal.

36.2 MOULDED CASE CIRCUIT BREAKERS

36.2.1 Moulded case circuit breakers shall comply with the latest Indian Standards and IEC standards. They shall have the voltage and current ratings, rated duty, rated short circuit service breaking capacity and rated short-time withstand current as indicated.

36.2.2 MCCB's shall be of the independent manual closing air-break type, rated for an uninterrupted duty, unless otherwise indicated.

Each MCCB shall have a facility for padlocking in the "OFF" position.

MCCB shall have front operating Extended door operating handle.

36.3 CURRENT TRANSFORMERS

Current Transformers shall be cast resin type.

a) All phases shall be provided with current transformers of accuracy Class I and suitable VA burden to operate associated metering.

b) Separate C.T's shall be used for protective devices

36.3.1 VOLTAGE TRANSFORMER:

Voltage transformers shall be cast resin type with accuracy class of 1.0.

36.4 RELAYS:

The contractor shall furnish, install and co-ordinate all relays to meet the requirement of protection, interlock and bus transfer scheme as indicated in BOQ, Drawing, Specification and system requirement. Relays shall be Microprocessor type.

36.5 EARTHING

All components, frame etc. shall be properly earthed. Al. earth bars of 50 mm x 6 mm shall be provided for the LT panel for the full length of the panel and connected to the frame work. Provisions shall be made for connection from this earth bar to the main earthing bar on both sides of LT Panel.

36.6 PAINTING

All steel work used in the construction of the LT panels shall have undergone a rigorous metal treatment process as follows:

i) Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.

ii) Pickling in dilute sulphuric acid to remove oxide scales & rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.

iii) A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.

iv) Passivating in de-oxalite solution to retain and augment the effects of phosphating.

v) Drying with compressed air in a dust free atmosphere

vi) Primer coating with two coats of a highly corrosion resistant primer, applied wet on wet and stove dried under strictly controlled conditions of temperature and time.

vii) Finishing treatment shall be by powder coating with 60 micron minimum thickness.

36.7 LABELS

Anodised Aluminium labels shall be provided on all incoming and outgoing feeder switches. Circuit diagram showing the arrangement of the circuit inside the LT panel shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet. Caution notice place shall be affixed at the back of each vertical panel.

36.8 SPACE HEATER AND PLUG SOCKET:

Each vertical panel shall be provided with thermostat controlled space heater and 5A 3pin plug socket. Separate transformer for space heating supply has to be arranged.

36.9 TESTING & COMMISSIONING

TEST AT MANUFACTURERS WORK

All routine tests specified in IS : 8623: shall be carried out Test witness Tests shall be performed in the presence of the Engineer-in-Charge. The contractor shall give at least fifteen days advance notice of the date when the tests are proposed to be carried out.

37. SPECIFICATION FOR STREET LIGHT & HIGHMAST

A. STEEL POLE:

Structural members for mounting street light fixtures shall be made up of HT steel conforming to grade S355JO. Bidders are required to supply conical poles and

associated accessories to last its designed life of minimum 25 years with least maintenance expenses and efforts.

Design: The Conical Poles shall be designed to withstand the maximum wind speed of 160 km/hr. The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS: 5649 / BSEN 40.

Pole Shaft: The pole shaft shall have circular cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding.

All conical pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside. The welding shall be done as per qualified MMAW process approved by Third Party Inspection agency. Rates quoted are deemed to be inclusive the TPIA wheresoever and for whatsoever mentioned in this tender document.

Door opening: The conical poles shall have door of approximate 500 mm length at the elevation of 500 mm from the Base plate. The door shall be vandal resistance and shall be weather proof to ensure safety of inside connections. The door shall be flush with the exterior surface and shall have suitable locking arrangement. The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.

Suitable arrangement for earthing shall be provided inside the pole as per IS 3043,OISD GDN 180 AND OISD 110.

Welding: The welding shall be carried out confirming to approved procedures duly qualified by third party inspection agency. The welders shall also be qualified for welding the conical shafts.

Conical Poles shall be preferably in single section upto 11meter without any circumferential weld joint.

The steel poles shall be hot dip galvanized as per IS 2629 / IS 2633 / IS 4759 standards with average coating of 80 micron. The galvanizing shall be done in single dipping.

The poles shall be bolted on a pre-cast RCC foundation with a set of four foundation bolts for greater rigidity. Bidder shall suggest design of the pole foundation and submit its calculations duly approved by TPI considering SBC-5 T/SQMTR.

Top Mountings & electrical accessories: Decorative bracket arm duly painted and preferably made up of galvanized steel shall be supplied along with the pole for fixing, lighting luminaries. Electrical accessories to be mounted inside each pole shall include stud type loop-in-loop out terminals suitable for LT cable and SP MCBs equal to no. of fixtures mounted on the poles.

Pole Testing Facility: The manufacturing unit shall have in-house pole testing facility for validation of structural design data. The pole testing facility shall conform to BS EN 40-3-2-2000 part 3-2.

Manufacturing Unit: The pole /bracket manufacturing & galvanizing unit shall be preferably ISO 9001: 2000 & ISO 14001 certified to ensure consistent quality & environmental protection.

B RAISING / LOWERING HIGH MAST

High masts shall be used for lighting tank farm area. Mast dimensions given below are guidelines only.

Structure: The High mast shall be of continuously tapered, polygonal cross section, at least 20 sided, presenting a good and pleasing appearance and shall be based on proven In- Tension design conforming to the standards referred to above, to give an assured performance, and reliable service. The structure shall be suitable for wind loadings as per IS 875 part3 1987.

Construction: The mast shall be manufactured using special steel plates, conforming to BS-EN10-025 and shall be delivered in multiple sections of effective length 10 meters. Thus a 30/25 m mast shall be delivered in three sections and 16 M /20 mast in 2 sections to site. Each section shall be fabricated out of single plate duly folded and welded. There shall be only one longitudinal seam weld per section. Sections with more than one weld, circumferential or longitudinal, shall not be accepted. At site the sections shall be joined together by slip-stressed-fit method. No site welding or bolted joint shall be done on the mast. The minimum over lap distance shall be 1.5 times the diameter at penetration. The minimum top diameter shall be 150 mm. Bottom diameter and plate thickness shall be as per the structural requirements. Detailed design calculation of the mast shall be submitted for verification. The mast shall be provided with fully penetrated flange, which shall be free from any lamination or incursion. The welded connection of the base flange shall be fully developed to the strength of the entire section. The base flange shall be provided with supplementary gussets between the bolt-holes to ensure elimination of helical stress concentration. For the environmental protection of the mast, the entire fabricated mast shall be hot dip galvanized, internally and externally, having a uniform average thickness of 85 microns for plates with more than 5 mm thickness and 70 microns for 5 mm or less. Galvanizing shall be done in single dipping method for better adhesion and life.

GALVANIZING TO BE WITNESSED BY TPI.

Door Opening: An adequate door opening shall be provided at the base of the mast and the opening shall be such that it permits clear access to equipment like winches, cables, plug and socket, etc. and also facilitate easy removal of the winch. The door opening shall be complete with a close fitting, vandal resistant, weatherproof door, provided with a heavy duty double internal lock with special paddle key. The door opening shall be carefully designed and reinforced with welded steel section, so that the mast section at the base shall be unaffected and undue buckling of the cut portion is prevented. Size of door opening shall not be more than 1200 x 250 mm to avoid buckling of the mast section under heavy wind conditions.

Dynamic Loading for the Mast: The mast structure shall be suitable to sustain an assumed maximum reaction arising from a wind speed as per IS 875 (three second gust), and shall be measured at a height of 10 metres above ground level. The design life of the mast shall be atleast 25 years. The force co-efficient taken for design of the polygonal structure is to be established from the wind tunnel test data. The manufacturer should have conducted wind tunnel at reputed laboratory or institute on sample model of high mast for deriving force coefficients (as per TR-7) and relevant test reports to be submitted in tender.

Lantern Carriage - Fabrication: A fabricated Lantern Carriage shall be provided for fixing and holding the flood light fittings and control gearboxes. The Lantern Carriage shall be of special design and shall be of steel tube construction, the tubes acting as conduits for wires, with holes fully protected by grommets. The Lantern Carriage shall

be so designed and fabricated to hold the required number of flood light fittings and the control gearboxes, and also have a perfect self-balance. The Lantern Carriage shall be fabricated in two halves and joined by bolted flanges with stainless steel bolts and nyloc type stainless steel nuts to enable easy installation or removal from the erected mast. The inner lining of the carriage shall be provided with protective PVC arrangement, so that no damage is caused to the surface of the mast during the raising and lowering operation of the carriage. The entire Lantern Carriage shall be hot dip galvanized after fabrication.

Junction Box: Weather proof junction box, made of Cast Aluminium shall be provided on the Carriage Assembly as required, from which the inter-connections to the designed number of the flood light luminaires and associated control gears fixed on the carriage, shall be made.

Raising and lowering machanism: For the installation and maintenance of the luminaires and lamps, it will be necessary to lower and raise the Lantern Carriage Assembly. To enable this, a suitable Winch Arrangement shall be provided, with the winch fixed at the base of the mast and the specially designed head frame assembly at the top.

Winch: The winch shall be of completely self sustaining type, without the need for brake shoe, springs or clutches. Each driving spindle of the winch shall be positively locked when not in use, gravity activated PAWLS. Individual drum also should be operated for fine adjustment of lantern carriage. The capacity, operating speed, safe working load, recommended lubrication and serial number of the winch shall be clearly marked on each winch. The gear ratio of the winch shall be 53: 1. However, the minimum-working load shall be not less than 750 kg. The winch shall be self - lubricating type by means of an oil bath and the oil shall be readily available grades of reputed producers. The winch drums shall be grooved to ensure perfect seat for stable and tidy rope lay, with no chances of rope slippage. The rope termination in the winch shall be such that distortion or twisting is eliminated and at least 5 to 6 turns of rope remains on the drum even when the lantern carriage is fully lowered and rested on the rest pads. It should be possible to operate the winch manually by a suitable handle or by an integral power tool. It shall be possible to remove the double drum after dismantling, through the door opening provided at the base of the mast. A test certificate shall be furnished by the Contractor from the original equipment manufacturer, for each winch in support of the maximum load operated by the winch. The winch shall be type tested through reputed institutions like IIT as consultants and the type test report shall be submitted along with offer. A test certificate is to be submitted along with supplies.

Head Frame: The head frame, which is to be designed, as a capping unit of the mast, shall be of welded steel construction, galvanized both internally and externally after assembly. The top pulley shall be of appropriate diameter, large enough to accommodate the stainless steel wire ropes and the multi-core electric cable. The pulley block shall be made of non-corrodable material, and shall be of die cast Aluminium Alloy (LM-6). Pulley made of synthetic materials such as Plastic or PVC are not acceptable. Self-lubricating bearings and stainless steel shaft shall be provided to facilitate smooth and maintenance free operation for a long period. The pulley assembly shall be fully protected by a canopy galvanized internally and externally. Close fitting guides and sleeves shall be provided to ensure that the ropes and cables do not dislodged from their respective positions in the grooves. The head

frame shall be provided with guides and stops with PVC buffer for docking the lantern carriage.

Stainless Steel Wire Ropes: The suspension system shall essentially be without any intermediate joint and shall consist of only non-corrodable stainless steel of AISI 316 grade. The stainless steel wire ropes shall be of 7/19 construction, the central core being of the same material. The overall diameter of the rope shall not be less than 6 mm. The breaking load of each rope shall not be less than 2350 kg. giving a factor of safety of over 5 for the system at full load as per the TR-7 referred to in the beginning of this specification . The end constructions of ropes to the winch drum shall be fitted with talurit. The thimbles shall be secured on ropes by compression splices. Two continuous lengths of stainless steel wire ropes shall be used in the system and no intermediate joints are acceptable in view of the required safety. No intermediate joints/terminations, either bolted or else, shall be provided on the wire ropes between winch and lantern carriage.

Electrical System, Cable and Cable Connections: Bottom electrical accessories of the mast shall be flame proof. A suitable flameproof plug socket unit shall be provided at the bottom compartment. This unit shall have facilities for terminating incoming cable (up to 4 core 16 sq mm Al Armoured). Out going of this unit shall be trailing cable for the mast through a plug. The electrical connections from the bottom to the top shall be made by special trailing cable. The cable shall be EPR insulated and PCP sheathed to get flexibility and endurance. Size of the cable shall be minimum 5 core 2.5 sq mm copper. The cable shall be of reputed make. At the top there shall be weatherproof junction box to terminate the trailing cable. Connections from the top junction box to the individual luminaires shall be made by using 3 core 1.5 sq. mm flexible PVC cables of reputed make. Also, suitable provision shall be made at the base compartment of the mast to facilitate the operation of internally mounted, electrically operated flame proof power tool for raising and lowering of the lantern carriage assembly.

Power Tool for the Winch: A suitable, high-powered, electrically driven, internally mounted power tool, with manual over ride shall be supplied for the raising and lowering of the lantern carriage for maintenance purposes. The speed of the power tool shall be to suit the system. The power tool shall be single speed, provided with a motor of the required rating. The power tool shall be supplied complete with suitable control. The capacity and speed of the electric motor used in the power tool shall be suitable for the lifting of the design load installed on the lantern carriage. The power tool mounting shall be so designed that it will be not only self-supporting but also aligns the power tool perfectly with respect to the winch spindle during the operations. Also, a handle for the manual operation of the winches in case of problems with the electrically operated tool shall be provided and shall incorporate a torque-limiting device. The power tool operation shall always be through a separate torque-limiting device to protect the wire ropes from over stretching. It shall be mechanical with suitable load adjusting device. The torque limitor shall trip the load when it exceeds the adjusted limits. There shall be suitable provision for warning the operator once the load is tripped off. The torque limitor is a requirement as per the relevant standards in view of the over all safety of the system. Each mast shall have its own power tool motor.

Lightning Finial: One number heavy duty hot dip galvanized lighting finial shall be provided for each mast. The lightning finial shall be minimum 1.2 M in length and

shall be provided at the centre of the head frame. It shall be bolted solidly to the head frame to get a direct conducting path to the earth through the mast. The lightning finial shall not be provided on the lantern carriage under any circumstances in view of safety of the system.

Aviation Obstruction Lights: Suitable Aviation Obstruction Lights of reliable design and reputed manufacturer shall be provided on top of each mast.

EarthingTerminals: 2 Nos. earth terminal using 12 mm diameter stainless steel bolts shall be provided at a convenient location on the base of the Mast, for lightning and electrical earthing of the mast. Each mast shall be earthed at two points using minimum 25x6 mm GI strip with two independent GI pipe earth electrodes of 40mm dia, 2.5 mtr long.

Feeder Pillar: Each mast shall be provided with a feeder pillar fabricated out of 14 SWG CRCA sheet and finished with two coats of red oxide primer and gray enamel paint of shade 631 of IS-5. The feeder pillar shall comprise of incoming TPN MCB, Copper wiring, outgoing terminals and contactors for reversing the motor.

5.3.17 R, Y, B to be fed from separate (dedicated) cables, so that if one phase goes out the luminaries connected with other phases should continue illumination.

B. LIGHTING LUMINAIRES AND LAMPS

Specifications given below pertain to street light luminaries, floodlight luminaries and its lamps. Bidders shall recommend wattage of luminaries based on their own design. Bidders shall attach detailed catalogue & technical data of the fixtures.

Street Lighting Luminaries

Street light luminaire shall be outdoor weatherproof integral type suitable for dusty and high traffic density roads.

The luminiare shall be epoxy powder coated made up of single piece die-cast aluminium housing for lamp, control gear accessories.

The luminiare shall have electrochemically brightened, polished finish computer aided pot optic aluminium reflector suitable for tubular lamp.

The luminaire shall have heat resistant toughened clear glass, rubber gasket with SS toggles & SS hardware.

The luminaire shall have easy access to control gear by top opening for maintenance purpose.

Degree of protection: Lamp housing compartment–IP 66; Control gear accessories housing compartment – IP 54.

The control gear compartment of the luminaire shall house open construction type low watt loss copper wound ballast, power factor improving capacitor, electronic ignitor and terminal block.

Ballasts: The ballast shall be copper wound, open type construction, vacuum impregnated low loss design. Ballasts shall be mounted using self locking, anti - vibration fixings and shall be easy to remove without demounting the fittings. Ballasts shall be provided with suitable taps to set the voltage range. End connections and taps shall be brought out to a suitable terminal block rigidly fixed to the ballast enclosure. Ballasts shall be free from hum and such of those which produce hum shall be replaced by contractor free of cost.

Capacitors: The capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits. The capacitors shall be

suitable for operation at supply voltage and shall have a value of capacitance so as to correct the power factor of its corresponding lamp circuit to the extent of 0.85 lag or better. The capacitors shall be hermetically sealed Lamps: 150/250/400 Watts SON-T plus lamps having higher lumens delivery. The lamps shall be capable of withstanding regular vibrations and the connections at lead in wires and filaments / electrodes shall not break under such circumstances. Lamps shall conform to relevant Indian Standards. Average life of the lamp shall be more than 20,000 burning hours.

Flood Lighting Luminaries

These floodlights shall be primarily used on highmasts. Bidders will decide the type of floodlights to be used based on their own design. Accessories like ballasts, capacitors, ignitors & lamps etc. shall conform to the corresponding IS & general specifications given in the clause 5.7.1 above.

Distinct features of the floodlights are given below.

Luminaire housing shall be epoxy powder coated having die-cast aluminium housing with heat dissipating fins.

The luminiare shall have electrochemically brightened, polished finish computer aided GLASKOTE reflector suitable for tubular lamp.

Glass: Heat resistant, clear, toughened glass fixed to the housing with SS toggles and silicon rubber gasket.

Lamp holder: GES lamp holder for tubular HID lamp, pre-wired up to the terminal block.

Mounting arrangement: MS hot dip galvanized and stove enameled mounting bracket.

Degree of protection: IP 55

Control gear box housing: Epoxy grey powder coated die-cast aluminium and hinged cover with rubber gasket.

Control gear box will house ballast, capcitor, ignitor, fuse, earth terminal and suitable connectors. These will be suitable for loop-in-loop-out.

Wiring of the luminaries

The wires for connection from terminal plate of the pole / highmast to the fixtures shall be 1100 V, minimum 3Cx2.5 sq mm PVC insulated, unarmoured having flexible copper conductors. The wires shall conform to the applicable IS.

39. LIST OF CONTRACT DRAWINGS

All additional working drawing to be supplied by the contractor after the acceptance of his tender and also those working drawings, which shall be supplied by the Engineer-in-charge during the construction will form part of this schedule.

APPENDIX – A

Method to be used for compression tests of concrete Samples during the progress of works:

Sampling the concrete

(a) Concrete for the test specimens shall be taken at the point of deposit to ensure that the specimens are representative of the concrete in the structure. A

number of samples shall be taken from different points. Each sample shall be large enough to make atleast one test specimen. Samples shall be taken from foundation Ring beam, all the braces, column section from brace to brace, Ring beam, bottom Dome and two samples from container walls. The samples shall be got tested by the contractor at his cost from any of the Engineering colleges or Govt. approved Laboratory. The location from which samples is taken shall be recorded.

(b) The test specimen

The test specimen shall be of 150 mm cube. The test specimens shall be made from each stage as mentioned above at which tests are required.

The mould shall be of metal inner faces accurately machined in order that the opposite side of specimens are plane and parallel. Each mould shall be provided with a metal base having a smooth machine surface. The interior surface of the mould and the base shall be lightly oiled before concrete is placed in the mould.

Test specimen shall be moulded by placing the fresh concrete in the mould in 50mm layers. At least 35 strokes of 25 mm bar shall be given in each layer.

Where mechanical vibrators are used for compacting the concrete the test specimens will be compacted with mechanical vibrator or by hand. The vibrators be used for members above 115mm x 115mm in size.

Test specimens shall be marked with the date of casting and when sent to the laboratories they shall be accompanied by particulars giving the proportion of the concrete and the position in the work from which the samples were taken.

(c) The storage of test specimens.

The test specimens shall be stored at the site at a place free from vibration under damp sacks for 24 hours (plus ½ hours) after which time they shall be removed from the mould marked and stored in water until the specimen shall be packed in suitable damp material for that purpose and will reach laboratory atleast 24 hours before the test where they shall be similar stores in water till test time.

(d) The test shall be made at the laboratory fixed by the Engineer at age of 28 days. Compression test shall be made between smooth plane steel plates without the packing and the load shall be applied exactly at the rate or approximately 2000 lbs, per sqinch (907.1kg per 6.44 sq.cm.) per minute. One compression plate of the test machines shall be provided with a ball seating in the form of a portion of a sphere, the center of which coincides with the central point of the face of plate. Test specimens shall be placed in the machine in such a manner that the load is applied to the sides of the specimens as these are cast.

(e) Standard of acceptance

The compressive strength shall be calculated in 150kg/ cm2 & 200 kg/cm2 & 250kg/ cm2 for M-150 & M-200 & M- 250 concrete mix respectively i.e. the max load sustained by the cubes before failure. The average of three specimens shall be accepted as the compressive strength of concrete, provided that the difference between the max. and min. strength of three specimens does not exceed 15% of average strength.

41. TECHNICAL SPECIFICATIONS VOLUME–II (PART-A) CIVIL WORK SPECIFICATIONS: -

The tender is for turnkey job and the responsibility of the contractor will include all preparatory work, levelling and dressing of site, detailed design(hydraulic & structural), procurement, excavation work including de-watering and lowering of sub- soil water if required, disposal of all surplus earth at suitable site, civil works, operation and maintenance for 6 months.

DESIGN & DRAWINGS:

The bidder shall quote his rates based on the scope of work. However, this shall not absolve the bidder from responsibility of performance of the asset created in this contract. The bidders are required to furnish the following documents at the time of award of contact.

a) Site Plan and Flow diagram / Plan layout./ civil structural drawings

The Scope of work for successful bidder includes:

(a) Submission of all documents required according to the contract parameter

d) RESIDUE MANAGEMENT:

Disposal of Solid Waste: Solid waste shall be the property of the department, however disposal of all solid waste including during O&M shall be responsibility of the contractor and will be thrown at 100 m distance

SCOPE OF WORK REQUIRED (CIVIL WORKS):

(Designed concrete will be minimum M-30 or more and steel Fe-500 grade for all Water retaining structures. For all other structures designed concrete will be minimum M-25 or more and steel Fe-500 grade.)

Stairs as per Requirement

RCC/MS staircase shall be provided to access all the platform provided/required for all the units above ground level. The tread width shall be minimum 230mm and c/c spacing between two consecutive treads shall not be more than 175 mm. The width of the staircase and their type shall be as approved by Engineer-in-charge before execution of the work

Railing along Platforms and stairs:

Railing along all platforms and stairs shall consist of 40mm GI pipe class B (two rows) & height of railing 0.9 m with CI vertical posts at distance of 2.0 m c/c .The vertical pipe apart from painting shall be epoxy coated also

External Sewerage System:

The external sewerage system consisting of suitable pipes shall be provided f or conveying the wastewater from all the units to the sump of Main pumping station. Required number of manholes shall be constructed as per drawings approved by Engineer-in-charge.

Painting, Whitewashing and Allied works

All the units or instruments of the MCC room shall be painted wherever required.

All the internal surfaces of the walls, ceiling of the building shall be painted with synthetic enamel paint. All the external surfaces of the building shall be either brick faced or plastered with cement sand mortar 1:4 and outside with cement based paint.

The inner concrete surfaces of all the water retaining structures including channel shall be painted (two coats) with approved make bitumen paint.

All the GI/ CI/DI pipes and specials and other equipment shall be painted with two coats of approved make anti corrosive paints.

42 PROVIDING & FIXING- 3D Ceramic Mural Art Work

Providing & Fixing 3 D Ceramic Mural Art W ork by a qualified Artist with Hand Made Ceramic Art Glazed Tiles of RAJA, PRABHA or eqvilent (the tiles of minimum thickness 8 to 10 mm) in assorted colors, sizes, cut to shape at site with three dimensional effect, 1‖ to 4‖ embossed as per requirement of the design from finishing with Tiles on sides also plus Clay modeled pieces in certain parts as per the Artist‘s recommendation and as per the requirement of the Design, duly approved by the Client or as per the direction of Engineer-in-charge. The material of the Tiles shall be of china clay mixed with other chemical like quartz, phelsphar, welsonite etc. The Tiles shall be Double Fired.

TECHNICAL– CERAMIC 3D MURAL ART WORK

The Designer will create approved Design on the wall first by sketching the whole Mural on wall. According to the requirement of the Design, levels will be created using cement mortar, steel rods etc. etc. Hand Made RAJA TILES will be cut to shape at site and with them shapes/three dimensional effects will be created at site, may be 1” to 6”-8” app. embossed as per requirement of the design from finishing with Tiles on sides also.

Regularly monitor the progress of the job and try to execute the job within the stipulated time.

HAND MADE CERAMIC GLAZED DMRC NUT JAALI (DOUBLE FIRED)

Hand Made Ceramic Glazed DMRC NUT JAALI in all colours and approved size of 5.5”X5.5”X1.5” thick. The material of the Jaali shall be of fine quality of china clay mixed with other component like quartz, phelsphar, welsonite etc. The contents are mixed and grind to make the clay ready to provide shape. To shape a particular model moulds and dies shall be used.

The Jaali shall be double fired, first at 1130-1200 C for the strengthening of the Jaali called bisquid and secondly in 1050-1100 c for the Glazing process. The second process ensures that the Glazed Jaali sustain the extreme weather conditions.

HAND MADE CERAMIC GLAZED ‘C’ TYPE JAALI (DOUBLE FIRED)

Hand Made Ceramic Glazed C‘ TYPE JAALI in all colors and approved size of 5”X2.5”. The material of the Jaali shall be of fine quality of china clay mixed with other component like quartz, phelsphar, welsonite etc. The contents are mixed and grind to make the clay ready to provide shape. To shape a particular model moulds and dies shall be used.

The Jaali shall be double fired, first at 1130-1200 C for the strengthening of the Jaali called bisquid and secondly in 1050-1100 c for the Glazing process. The second process ensures that the Glazed Jaali sustain the extreme weather conditions.

HAND MADE CERAMIC ART GLAZED TILES (DOUBLE FIRED)

HAND Made Ceramic Art Glazed Tiles of minimum thickness of 6-8 mm, in all colors, shades of any size approved. The Tiles are square, rectangular of nominal size such as 2”X2”3”X3” 4”X4” 6”X1” 6”X3” 8”X4” 9”X3”. The material of the Tiles is fine quality of china clay mixed with other chemicals like quartz, phelsphar and welsonitee etc. The contents are mixed and grind to make the clay ready to provide shape. To shape a particular Tile, ready clay is pressed in dies in 100-ton presses for sufficient strength.

The Tiles are Double Fired, first at 1130-1200 C for the strengthening of the Tiles called Bisque and secondly at 1050-1100 C for the glazing process. The second process ensures that the glazed Tiles sustain the extreme weather conditions.

All the industrial norms and quality standards are diligently followed at all times. All the Tiles manufactured at our factory are tested and certified by Shriram Institute for Industrial Research, Delhi

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ISO 9001-2015 Certified Testing Laboratory

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REPORT ID :

MM5251092022

SOIL INVESTIGATION REPORT

Name of Work: Construction of Indoor Stadium at Chamba,(HP)

Reference No: KEC/Chamba/22-23/04

IssuedTo: M/s Kumar Enterprises & Co.
12341 Chamba,2341 176310
Upper Julakari Chamba
Town,Chamba-HP.

Report Issue Date:- 10.09.2022

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1. INTRODUCTION

There is a proposal for construction of building at village – xxxx in Chamba District in Himachal Pradesh. There is a requirement of soil investigation for evaluating safe bearing capacity of soil required in design of foundation of structure. The objective of the report is restricted to the factual information to be collected during the investigation period along with laboratory tests results and so as to obtain sequence & extent of soil so as to arrive at design parameters for the foundations from the recommended safe bearing capacity of foundation soil.

2. SCOPE OF WORK

2.1. Reconnaissance / field trip for studying the general topography and geology of the area/ terrain

2.2. The field Geo-tech investigations consisted of four Nos. of bore hole up to5.00 m depth w.r.t the existing Surface Level as per IS code.

2.3. Conducting SPT in the bore-hole at regular intervals of 1.5 m and collecting disturbed/undisturbed soil samples from the bores hole and conducting field density tests as per Indian code of practice.

2.4. Conducting DCPT after refusal by SPT at the same location or where SPT is not possible..

2.5. Recording of water table level in the bore holes at the time of boring (if encountered).

2.6. Conducting laboratory tests on the samples collected and thereby determining various index and engineering properties and summarizing the detail of soil classification.

2.7. Collecting rock cores during drilling in rocky strata in suitable wooden core boxes and maintaining the record of core recovery, RQD, water loss etc.

2.8. Conducting all necessary and relevant laboratory test on representative rock samples like density, moisture content, Specific Gravity, UCS, porosity etc.

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2.9. A comprehensive Geotechnical investigation report embodying all the required information along with tables of Field / Lab tests results and bearing capacity computations.

3.0 FIELD INVESTIGATION

Testing equipment and personnel for carrying out the requisite field works were mobilized to the site. These were shifted from one test location to another location during the course of fieldwork and demobilized after satisfactory completion of entire field work.

The prescribed one borehole of 150mm/76mm dia was drilled in soil/boulders/rock stratum at the proposed structure sites in accordance with IS: 1892 - 1976.

Standard penetration tests

Standard penetration tests were conducted in the borehole at regular depth intervals of 1.50m. Standard split spoon sampler is attached to lower end of 'A' size drill rods and driven into borehole by means of a standard hammer of 63.5 kg falling freely from a height of 75 cm. The sampler was driven 45cm into soil by blows of this hammer and the numbers of blow required for each 15 cm penetration were recorded. Blows required for first 15cm penetration are not taken into account for N value as it is considered as seating drive. The number of blows for last 30 cm penetration is designated as SPT 'N' values. A 'refusal' has been indicated where there is less than 30 cm penetration in more than 100 blows. SPTs were conducted in overburden only and NO SPTs were conducted in rocky/bouldary region.

Soil samples obtained from standard split spoon sampler for all above standard penetration tests were collected in the polythene bags of suitable size. These samples were properly sealed, labeled, recorded and carefully transported to the laboratory for further testing.

Un-disturbed soil samples were also collected by using thin walled steel sampling tubes of 100mm dia and 450mm length from all the bores at regular intervals as per IS: 2131-1986. These sampling tube after retrieval from the boreholes were properly waxed and sealed on both ends. These were carefully labeled and transported to the laboratory for testing.

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Dynamic Cone Penetration tests

DCPT or Dynamic Cone Penetration tests were carried out at the borehole location where there was no possibility of conducting SPT test or a refusal for SPT 'N' value was observedfor gravelly or bouldary strata as entrusted by client for the purpose of determination of SBC regarding suitable type of foundation design works.

Dynamic Cone Penetration Test (DCPT) is carried out to know insitu measurement of structural property in terms DCPT blows in gravelly/bouldary terrain which can be correlated with SPT 'N' values. By this equipment, continuous measurement of penetration resistance is recorded and graph is plotted between depth v/s no. of blows. These tests were conducted in accordance with the procedure laid down in IS: 4968-1976 "Method for Sub Surface Sounding for Soil. Part-I Dynamic Method using 50mm cone without bentonite slurry.DCPT is conducted by using a 50 mm diameter 60^0 cone fitted loosely to the driving rod through a cone adopter or the threaded cone, screwed to the driving rod. The hammer head is then joined to the other end of the driving rod with rod coupling. A guide rod 150 cm long is connected to the hammer head. This assembly has to be kept vertical with the cone resting on the ground to be tested. The cone is, then be driven into the soil by allowing the 65 kg hammer to fall freely through a height of 750 mm each time. The numbers of blows for every 100 mm penetration of the cone are recorded. The process is repeated till the cone is driven to the required depth or up to refusal (35 blows for 100mm penetration).

Sample collection in case of DCPT

Undisturbed soil samples were collected from a pit which was excavated adjacent to DCPT location. The undisturbed samples were collected in sampling tubes. The ends of the tubes are sealed with molten wax to prevent evaporation. These samples were subsequently tested in the laboratory so as to determine the various index and engineering proportion of various sub soil strata met in the bore holes.

The ground water table in borehole generally measured after 24 hours of the boring or after the full stabilization of water level in boreholes.

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4.0 LABORATORY INVESTIGATION

The following laboratory tests were conducted on selected soil samples recovered from the boreholes:

(a) Bulk density, Dry Density and Moisture Content,

(b) Grain Size analysis

(c) Atterberg limits,

(d) Shear strength parameters, Direct Shear Test

(e) Consolidation Properties:

(f) Specific Gravity Tests

The above laboratory tests were carried out as per relevant Indian standard code of practice. All the soil samples were identified and classified as per IS: 1498-1970. The results of laboratory tests are shown in soil profile sheets. Some of the tests are described as below:

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5.0 OBSERVATION AND DISCUSSION OF TEST RESULTS

Based on the details obtained from the field and laboratory test results, the sub soil stratum is classified as under;

Borehole BH-1 TO BH-4

The sub stratum of borehole BH-1,consists of Silty Sand Mixed With Gravels from 0.00m to 2.25m depth andBoulderswith Gravels and Sandfrom 2.25m to 5.00m depth.

The sub stratum of borehole BH-2,consists of Silty Sand Mixed With Gravels from 0.00m to 2.25m depth and Boulders with Gravels and Sandfrom 2.25m to 5.00m depth.

The sub stratum of borehole BH-3,consists of Silty Sand Mixed With Gravels from 0.00m to 2.00m depth and Boulders with Gravels and Sandfrom 2.00m to 5.00m depth.

The sub stratum of borehole BH-4,consists of Silty Sand Mixed With Gravels from 0.00m to 2.00m depth and Boulders with Gravels and Sandfrom 2.00m to 5.00m depth.

Water table was NOT met up to drilled depth of 5.00m in all these boreholes during investigation period.

The stratum is highly stiff/compacted throughout the depth.

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6.0 ESTIMATION OF ALLOWABLE BEARING CAPACITY

A properly designed foundation must satisfy the following basic requirements:

(i) Foundation must be safe against the shear failure of the supporting soil.

(ii) The settlement of foundation must be within permissible limit.

The bearing capacities have been determined separately to satisfy both the above mentioned requirements and the smaller of the two values has been recommended as the allowable bearing capacity.

6.1 BEARING CAPACITY FROM SHEAR CONSIDERATIONS

In shear, a foundation can fail in any of the three different ways viz.

(i) Local shear failure

(ii) General shear failure

(iii) In between the above two

The local Shear Failure is assumed to occur for ϕ less than 28.5° & general shear failure for ϕ>36° & between these limiting value of ϕ, interpolated values for local & general shear failure can be determined. In this case bearing capacity for shear failure consideration has been determined.

Adopting a square isolated foundation of 2.00m x 2.00mand taking the depths from 1.50 m to 4.50m below O.G.L. and using Eq.2 below as per code IS 6403 – 1981: "Code of practice for determination of bearing capacity of shallow foundations" and also using codes IS 8009 (Part I) - 1978: Code of practice for calculation of settlements of foundations and IS: 1904-1978 "Structural Safety for Buildings: Shallow Foundation" SBC has been determined.

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$$q_a = 1/F[2/3\ C\ N`_c s_c\ d_c\ i_c + \gamma D_f\ (N`_q - 1) s_q\ d_q\ i_q + 0.5\ \gamma B N`_\gamma\ s_\gamma\ d_\gamma i_\gamma W'] + \gamma D_f \quad \ldots\ldots\ldots\ldots (2)$$

where q_a = Allowable Safe Bearing Capacity

F = Factor of safety taken as 2.5

C_m = Modified cohesive strength

γ = Unit Weight of Soil

D_f = Depth of foundation

B = Width of foundation

$N`_c N`_q\ N`_\gamma$ = Modified bearing capacity factors

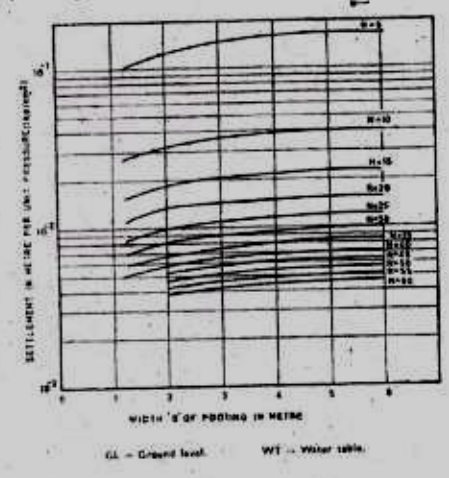
s_c, s_q, s_γ = Shape factors

d_c, d_q, d_γ = Depth factors

i_c, i_q, i_γ = Inclination factor

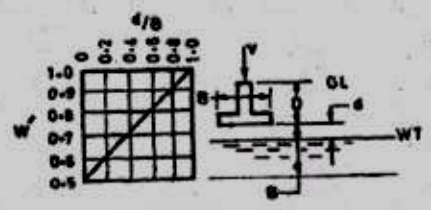
BEARING CAPACITY FROM SETTLEMENT CRITERIA

(Based on SPT test conducted in the field)
Standard Penetration Tests are very popular in geotechnical testing field, and have sufficient literature supporting for determination of safe bearing capacity through SPT 'N' values.



GL – Ground level WT – Water table

IS : 8009 (Part I) - 1976



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For such cases, first, Dynamic Cone Penetration resistance values (Ncd) for 30 cm penetration are converted in to Standard Penetration Resistance values (N') with available literature or CBRI formulae or locally tested and created interpolation of Ncd and N values.
These derived N values are used for further analysis of allowable bearing pressure.

As per CBRI
Ncd = 1.5 N up to 4.00m depth
andNcd = 1.75 N up from 4.00 to 9.00m depth

The amount of settlement under a given pressure for cohesionless soils can be determined by the chart given in IS-8009 using SPT "N" values (quoted below). To the vice versa, allowable bearing pressure is calculated by adopting a fixed allowable settlement.

The foundation should not settle or deflect to an extent causing damage to structure or impair its usefulness. Allowable settlement for particular type of foundation / structure can be taken from IS 1904-1986.

For this project, the maximum settlement of foundation has been considered to 50 mm as per IS 1904-1986.

7. RECOMMENDATIONS

Recommended bearing capacity for different types of foundation has been given at the end of this report.

NOTE:

1. The area under investigation falls under seismic zone-IV as per India seismic code.
2. It is also suggested that the backfilling of the foundation soil should be well compacted inlayer at optimum moisture content to achieve at least 95% of proctor density, followed by suitable plinth protection & effective drainage system.
3. For any other size and depth of footing bearing capacity of soil can be calculated from the data provided.

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LIST OF I.S. CODES

FIELD INVESTIGATION:

1.	IS : 1498 – 1970	:	Classification and Identification of soils for general engineering purpose (First Revision).
2.	IS : 1892 – 1979	:	Code of practice for sub surface investigation for foundations (First Revision).
3.	IS : 2131 – 1981	:	Method of Standard Penetration Tests for soils.
4.	IS : 12070 – 1987	:	Safe Bearing Capacity of Foundations on Rock
5.	IS 9143 (1979)	:	Code of practice for Unconfined Compression Test
6.	IS 8764 (1998)	:	Code of practice for Point Load Index Test
7.	IS : 1080 – 1986	:	Code of practice for design and construction of shallow foundations on soils (other than raft, ring and shell) (Second Revision).
8.	IS : 1904 – 1986	:	Code of practice for design and construction of foundation in soils : General requirements.
9.	IS 6403 – 1981	:	Code of practice for determination of bearing capacity of shallow foundations.
10.	IS 8009 – 1976 (Part – 1&2)	:	Code of practice for calculations of settlements of foundations : shallow foundations subject to symmetrical static vertical loads.
11.	IS 2720 – Various parts	:	Methods of test for soils

NOTATIONS USED

N	=	Observed SPT value
C_N	=	Correction factor
N_0	=	Corrected SPT values
Y	=	Bulk unit weight
Y'	=	Submerged unit weight
Y_d	=	Dry unit weight
Y_{sat}	=	Saturated unit weight
G	=	Specific gravity of soil

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Q_u	=	Unconfined compressive strength
C	=	Effective cohesional parameter
$Ø_A$	=	Effective/ Average angle of shearing resistance
$Ø_m$	=	Mobilized angle of shearing resistance
N Ø	=	Flow value $Tan^2 (45 + Ø / 2)$
C_c	=	Compression index
B	=	Width of foundation
L	=	Length of foundation
D	=	Depth of foundation
q	=	Effective surcharge
S.S.W.L.	=	Sub soil water level
W'	=	W.T. correction factor
q_{ut}	=	Net ultimate bearing capacity
q_{sb}	=Net safe bearing capacity	
q_n	=	Net foundation loading intensity for a given settlement
q_{up}	=	Safe Uplift Pressure
WT	=	Water table
S_t	=	Total settlement
S_a	=	Maximum allowable settlement

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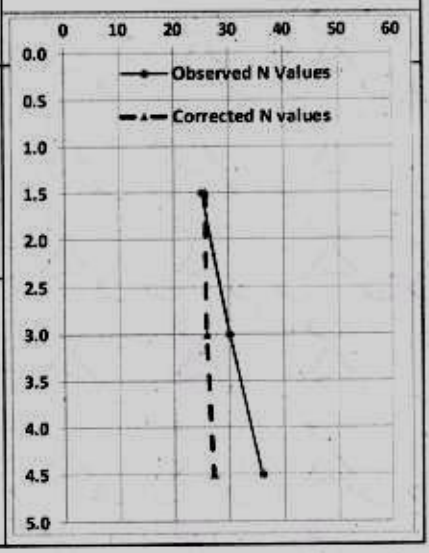
LOG OF BOREHOLE, BH-1

PROJECT								BOREHOLE NO.
GEOTECHNICAL INVESTIGATION FOR CONSTRUCTION OF BUILDING STRUCTURE, DISTT-CHAMBA IN HIMACHAL PRADESH								BH-1
LOCATION				DATE OF DRILLING		TERMINAL DEPTH		WATER TABLE (m)
1				08.09.2022		5.00 m		NIL

DEPTH M	OBSERVED N VALUE	CORRECTED N VALUE	SAMPLE TYPE	SAMPLE DEPTH IN M	DESCRIPTION OF STRATA	LOG	IS SOIL CLASSIFICATION
0.00					SAND WITH GRAVELS	0.00-2.25	SM
0.75			DS-1	0.75-1.00			
1.50	25	25.7	SPT-1	1.50-1.95			
2.25			UDS-1	2.25-2.55			
3.00	30	25.9	SPT-2	3.00-3.45	BOULDERS WITH GRAVELS AND SAND	2.25-5.00	GM
3.75			DS-2	3.75-4.05			
4.50	36	27.1	SPT-3	4.50-4.95			
5.00							

STANDARD PENETRATION RESISTANCE CURVE



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Report No.MM5251092022 PAGE NO.13

LABORATORY TEST RESULTS, BH-1

BH-1		GRAIN SIZE ANALYSIS						ATTERBERG LIMITS			DENSITY & MOISTURE CONTENT					SHEAR PARAMETERS		
SAMPLE DEPTH IN M	SAMPLE NO.	CLAY	SILT	fine SAND	med SAND	coarse SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY	MOISTURE CONTENT	DRY DENSITY	SPECIFIC GRAVITY	VOID RATIO	TEST TYPE	COHESION, in kg/cm^2	ANGLE OF INTERNAL FRICTION, in Degree
		<0.002 mm	0.002-0.075	0.075-0.425	0.425-2.00	2.00-4.75	>4.75 mm											
		%	%	%	%	%	%	%	%	%	gm/cc	%	gm/cc	G	e		c	ϕ
0.75-1.00	DS-1	0.0	17.0	48.6	22.3	8.5	3.6	-	NP		-	-	-	-	-	-	-	-
2.25-2.55	UDS-1	0.0	22.6	45.2	15.2	8.8	8.2	-	NP		1.708	8.2	1.579	2.65	0.679	DIR	0.00	32.3
3.75-4.05	DS-2	0.0	14.2	20.7	13.6	11.2	40.3	-	NP		-	-	-	-	-	-	-	-

GRAIN SIZE PRESENTED HERE IS THAT OF PARTICLES PASSING 20mm, ALTHOUGH BIGGER SIZE PARTICLES IN SIGNIFICANCE QUANTITY PRESENT AT SITE.

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CALCULATION OF SAFE BEARING CAPACITY BASED ON SHEAR CRITERIA, BH-1

BH-1			Type of Foundation = Open, Isolated									Water Table Correction factor = 0.5							
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion 'c' t/m2	Angle of Shearing Resistance 'ϕ' degree	Bearing Capacity Factors			Depth Factors			Shape Factors			Bearing Capacity BC1=2/3c.Nc.dc.sc.ic	Bearing Capacity BC2=γ.D.(Nq-1).dq.sq.iq	Bearing Capacity BC3=0.5.γ.B.Nγ.dγ.sγ.iγ.W'	Total Bearing Capacity BC=BC1+BC2+BC3	Net Safe Bearing Capacity S.B.C.(Net)=BC/FOS
D	L	B	γ	c	ϕ	Nc'	Nq'	Nγ'	dc	dq	dγ	sc	sq	sγ	BC1	BC2	BC3		T/m²
1.5	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	23.2	11.0	34.2	13.7
2.0	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	30.9	11.0	41.9	16.8
2.5	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	38.6	11.0	49.6	19.9
3.0	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	46.4	11.0	57.4	22.9
3.5	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	54.1	11.0	65.1	26.0
4.0	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	61.8	11.0	72.8	29.1
4.5	2.0	2.0	1.708	0.0	32.3	17.9	8.5	8.0	1.0	1.0	1.0	1.3	1.2	0.8	0.0	69.6	11.0	81	32.2

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CALCULATION OF SAFE BEARING CAPACITY BASED ON SETTLEMENT CRITERIA, BH-1

Depth in m	Average N Value	Width of Foundation, m	Settlement in mm by applying 1kg/sq.cm pressure	Corrected settlemnt in mm by applying w'	ABP in kg/sq.cm for allowed 50mm settlement	ABP without Depth Factor in T/sq.m	Depth Factor	Net ABP in T/sq.m
D	N	B	mm	mm	kg/cm^2	T/m^2	T/m^2	T/m^2
1.5	25.9	2.0	12.2	24.3	2.05	20.5	1.15	23.6
2.0		2.0	By Interpolation			20.9	1.20	25.0
2.5		2.0	By Interpolation			21.2	1.20	25.4
3.0	27.1	2.0	11.6	23.2	2.15	21.5	1.20	25.8
3.5		2.0	By Interpolation			23.0	1.20	27.6
4.0		2.0	By Interpolation			24.6	1.20	29.5
4.5	32.8	2.0	9.6	19.2	2.61	26.1	1.20	31.3

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RECOMMENDED SAFE BEARING CAPACITY, BH-1

Depth	Width of Footing	Net SBC		
		Shear Criteria	Settlement Criteria	Recommended
m	m	T/m^2	T/m^2	T/m^2
1.50	2.00	13.7	23.6	13.7
2.00	2.00	16.8	25.0	16.8
2.50	2.00	19.9	25.4	19.9
3.00	2.00	22.9	25.8	22.9
3.50	2.00	26.0	27.6	26.0
4.00	2.00	29.1	29.5	29.1
4.50	2.00	32.2	31.3	31.3

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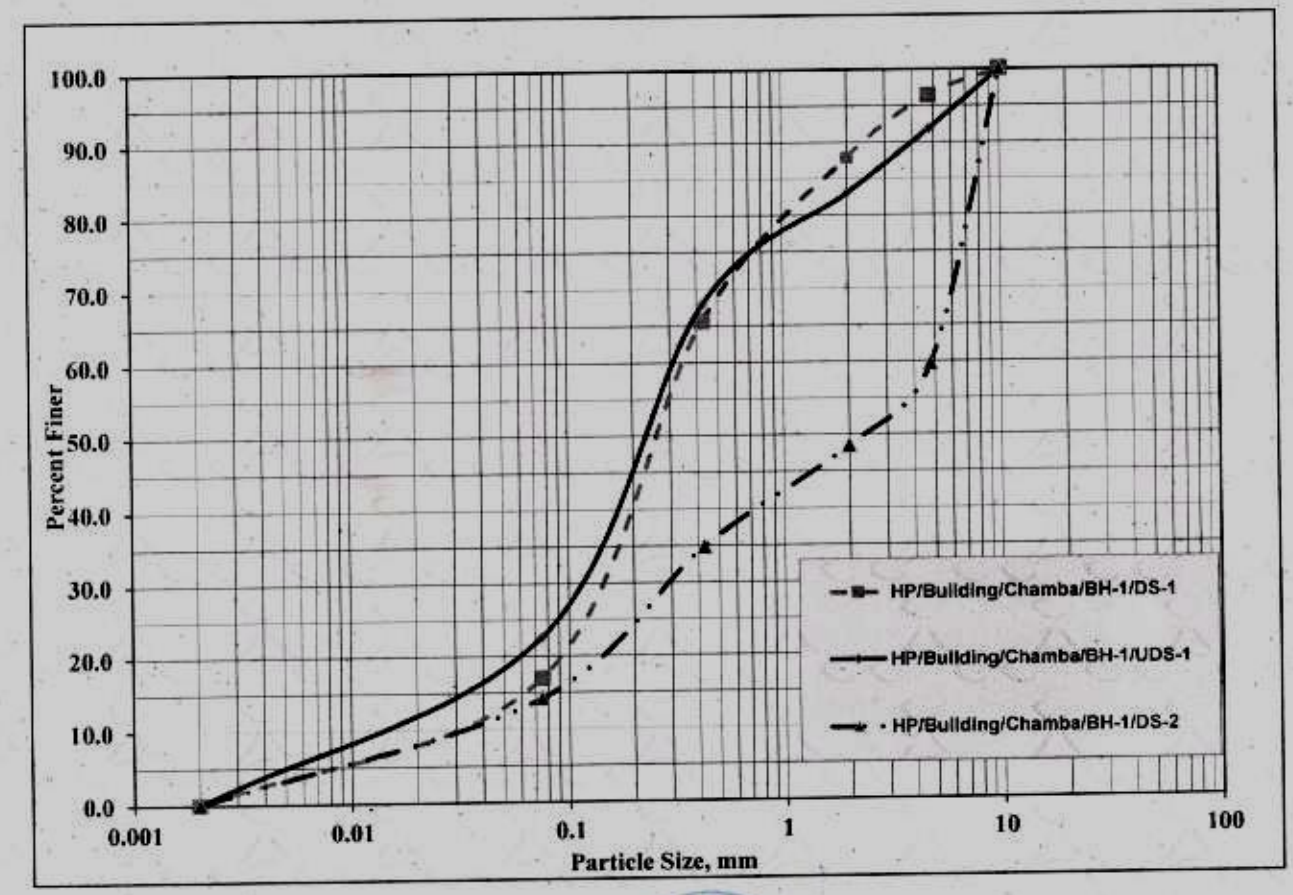
GRAIN SIZE DISTRIBUTION CURVE, BH-1



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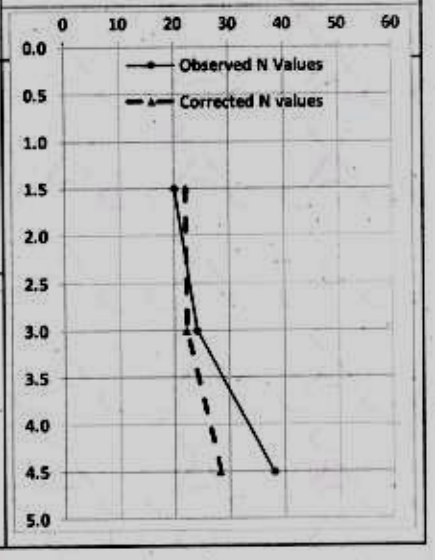
LOG OF BOREHOLE, BH-2

PROJECT	BOREHOLE NO.
GEOTECHNICAL INVESTIGATION FOR CONSTRUCTION OF BUILDING STRUCTURE, DISTT-CHAMBA IN HIMACHAL PRADESH	BH-2

LOCATION	DATE OF DRILLING	TERMINAL DEPTH	WATER TABLE (m)
2	08.09.2022	5.00 m	NIL

DEPTH M	OBSERVED N VALUE	CORRECTED N VALUE	SAMPLE TYPE	SAMPLE DEPTH IN M	DESCRIPTION OF STRATA	LOG	IS SOIL CLASSIFICATION
0.00					SAND WITH GRAVELS	0.00-2.25	SM
0.75			DS-1	0.75-1.00			
1.50	20	22.1	SPT-1	1.50-1.95			
2.25			UDS-1	2.25-2.55			
3.00	24	22.2	SPT-2	3.00-3.45	BOULDERS WITH GRAVELS AND SAND	2.25-5.00	GM
3.75			DS-2	3.75-4.05			
4.50	38	28.2	SPT-3	4.50-4.95			
5.25							

STANDARD PENETRATION RESISTANCE CURVE



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LABORATORY TEST RESULTS, BH-2

BH-2		GRAIN SIZE ANALYSIS						ATTERBERG LIMITS			DENSITY & MOISTURE CONTENT					SHEAR PARAMETERS		
SAMPLE DEPTH IN M	SAMPLE NO.	CLAY	SILT	fine SAND	med SAND	coarse SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY	MOISTURE CONTENT	DRY DENSITY	SPECIFIC GRAVITY	VOID RATIO	TEST TYPE	COHESION, in kg/cm^2	ANGLE OF INTERNAL FRICTION, in Degree
		<0.002 mm	0.002-0.075	0.075-0.425	0.425-2.00	2.00-4.75	>4.75 mm											
		%	%	%	%	%	%	%	%	%	gm/cc	%	gm/cc	G	e		c	♦
0.75-1.00	DS-1	0.0	16.2	51.1	18.7	7.4	6.6	-	NP		-	-	-	-	-	-	-	-
2.25-2.55	UDS-1	0.0	19.0	42.5	14.7	7.6	16.2	-	NP		1.704	7.3	1.588	2.65	0.669	DIR	0.00	32.0
3.75-4.05	DS-2	0.0	13.0	18.5	13.1	10.4	45.0	-	NP		-	-	-	-	-	-	-	-

GRAIN SIZE PRESENTED HERE IS THAT OF PARTICLES PASSING 20mm, ALTHOUGH BIGGER SIZE PARTICLES IN SIGNIFICANCE QUANTITY PRESENT AT SITE.

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CALCULATION OF SAFE BEARING CAPACITY BASED ON SHEAR CRITERIA, BH-2

BH-2			Type of Foundation = Open, Isolated									Water Table Correction factor = 0.5							
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion 'c' t/m2	Angle of Shearing Resistance 'ϕ' degree	Bearing Capacity Factors			Depth Factors			Shape Factors			Bearing Capacity BC1=2/3c.Nc.dc.sc.ic	Bearing Capacity BC2=γ.D.(Nq-1).dq.sq.iq	Bearing Capacity BC3=0.5.γ.B.Nγ.dγ.sγ.iγ.W'	Total Bearing Capacity BC=BC1+BC2+BC3	Net Safe Bearing Capacity S.B.C.(Net)=BC/FOS
D	L	B	γ	c	ϕ	Nc'	Nq'	Nγ'	dc	dq	dγ	sc	sq	sγ	BC1	BC2	BC3		T/m^2
1.5	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	22.5	10.6	33.1	13.2
2.0	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	30.0	10.6	40.6	16.2
2.5	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	37.5	10.6	48.1	19.2
3.0	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	45.0	10.6	55.6	22.2
3.5	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	52.5	10.6	63.1	25.2
4.0	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	60.0	10.6	70.6	28.2
4.5	2.0	2.0	1.704	0.0	32.0	17.6	8.3	7.8	1.0	1.0	1.0	1.3	1.2	0.8	0.0	67.5	10.6	78	31.2

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TEST CERTIFICATE

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CALCULATION OF SAFE BEARING CAPACITY BASED ON SETTLEMENT CRITERIA, BH-2

Depth in m	Average N Value	Width of Foundation, m	Settlement in mm by applying 1kg/sq.cm pressure	Corrected settlemnt in mm by applying w'	ABP in kg/sq.cm for allowed 50mm settlement	ABP without Depth Factor in T/sq.m	Depth Factor	Net ABP in T/sq.m
D	N	B	mm	mm	kg/cm^2	T/m^2	T/m^2	T/m^2
1.5	22.2	2.0	14.2	28.4	1.76	17.6	1.15	20.3
2.0		2.0	By Interpolation			19.2	1.20	23.1
2.5		2.0	By Interpolation			20.8	1.20	25.0
3.0	28.2	2.0	11.2	22.3	2.24	22.4	1.20	26.9
3.5		2.0	By Interpolation			23.6	1.20	28.4
4.0		2.0	By Interpolation			24.9	1.20	29.8
4.5	32.9	2.0	9.6	19.2	2.61	26.1	1.20	31.3

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TEST CERTIFICATE

Report No.MM5251092022

RECOMMENDED SAFE BEARING CAPACITY, BH-2

Depth	Width of Footing	Net SBC		
		Shear Criteria	Settlement Criteria	Recommended
m	m	T/m^2	T/m^2	T/m^2
1.50	2.00	13.2	20.3	13.2
2.00	2.00	16.2	23.1	16.2
2.50	2.00	19.2	25.0	19.2
3.00	2.00	22.2	26.9	22.2
3.50	2.00	25.2	28.4	25.2
4.00	2.00	28.2	29.8	28.2
4.50	2.00	31.2	31.3	31.2

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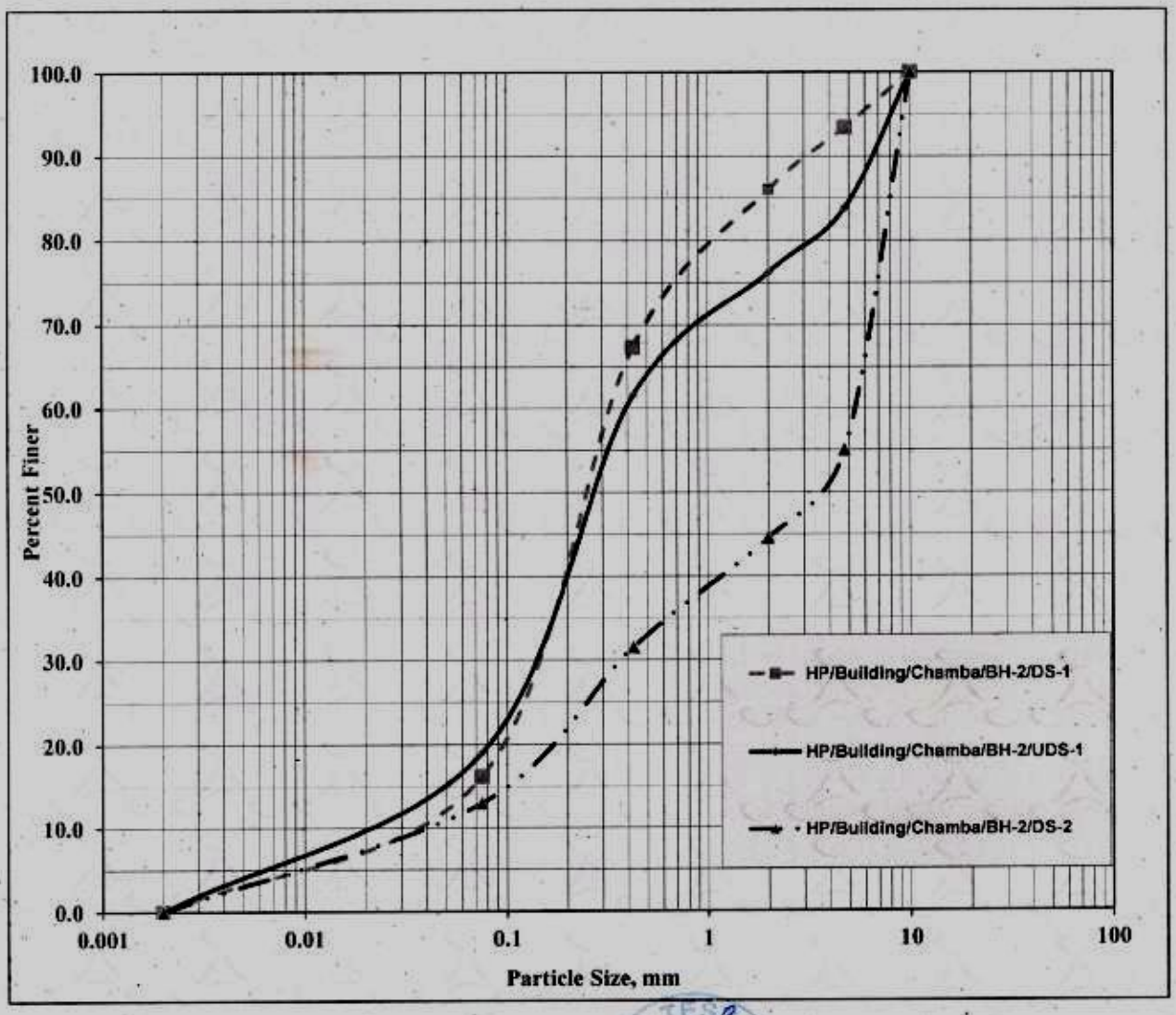
TEST CERTIFICATE

Report No.MM5251092022

GRAIN SIZE DISTRIBUTION CURVE, BH-2



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TEST CERTIFICATE

Report No.MM5251092022

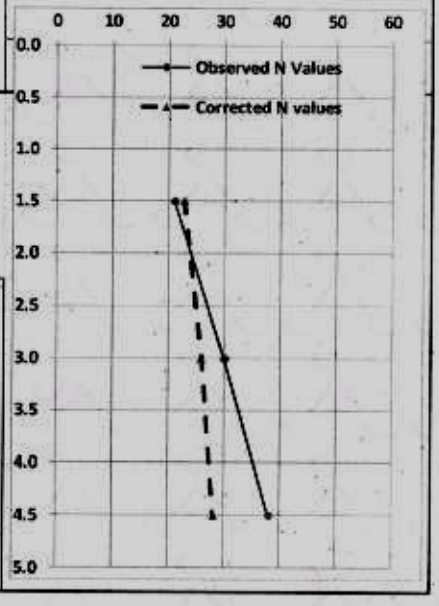
LOG OF BOREHOLE, BH-3

PROJECT	BOREHOLE NO.
GEOTECHNICAL INVESTIGATION FOR CONSTRUCTION OF BUILDING STRUCTURE, DISTT-CHAMBA IN HIMACHAL PRADESH	BH-3

LOCATION	DATE OF DRILLING	TERMINAL DEPTH	WATER TABLE (m)
3	08.09.2022	5.00 m	NIL

DEPTH M	OBSERVED N VALUE	CORRECTED N VALUE	SAMPLE TYPE	SAMPLE DEPTH IN M	DESCRIPTION OF STRATA	LOG	IS SOIL CLASSIFICATION
0.00					SAND WITH GRAVELS	0.00-2.00	SM
0.75			DS-1	0.75-1.00			
1.50	21	22.8	SPT-1	1.50-1.95			
2.25			UDS-1	2.25-2.55	BOULDERS WITH GRAVELS AND SAND	2.00-5.00	GM
3.00	30	25.9	SPT-2	3.00-3.45			
3.75			DS-2	3.75-4.05			
4.50	38	28.2	SPT-3	4.50-4.95			
5.00							

STANDARD PENETRATION RESISTANCE CURVE



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TEST CERTIFICATE

Report No.MM5251092022

LABORATORY TEST RESULTS, BH-3

BH-3		GRAIN SIZE ANALYSIS						ATTERBERG LIMITS			DENSITY & MOISTURE CONTENT					SHEAR PARAMETERS		
SAMPLE DEPTH IN M	SAMPLE NO.	CLAY	SILT	fine SAND	med SAND	coarse SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY	MOISTURE CONTENT	DRY DENSITY	SPECIFIC GRAVITY	VOID RATIO	TEST TYPE	COHESION, in kg/cm^2	ANGLE OF INTERNAL FRICTION, in Degree
		<0.002 mm	0.002-0.075	0.075-0.425	0.425-2.00	2.00-4.75	>4.75 mm											
		%	%	%	%	%	%	%	%	%	gm/cc	%	gm/cc	G	e		c	ϕ
0.75-1.00	DS-1	0.0	14.1	46.6	22.7	9.9	6.7	-	NP		-	-	-	-	-	-	-	-
2.25-2.55	UDS-1	0.0	15.0	37.0	21.1	9.4	17.5	-	NP		1.709	8.0	1.582	2.66	0.681	DIR	0.00	31.8
3.75-4.05	DS-2	0.0	11.9	15.9	17.8	9.9	44.5	-	NP		-	-	-	-	-	-	-	-

GRAIN SIZE PRESENTED HERE IS THAT OF PARTICLES PASSING 20mm, ALTHOUGH BIGGER SIZE PARTICLES IN SIGNIFICANCE QUANTITY PRESENT AT SITE.

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TEST CERTIFICATE

Report No.MM5251092022

CALCULATION OF SAFE BEARING CAPACITY BASED ON SHEAR CRITERIA, BH-3

BH-3			Type of Foundation = Open, Isolated									Water Table Correction factor = 0.5							
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion 'c' t/m2	Angle of Shearing Resistance 'ϕ' degree	Bearing Capacity Factors			Depth Factors			Shape Factors			Bearing Capacity BC1=2/3c.Nc.dc.sc.ic	Bearing Capacity BC2=γ.D.(Nq-1).dq.sq.iq	Bearing Capacity BC3=0.5.γ.B.Nγ.dγ.sγ.iγ.W'	Total Bearing Capacity BC=BC1+BC2+BC3	Net Safe Bearing Capacity S.B.C.(Net)=BC/FOS
D	L	B	γ	c	ϕ	Nc'	Nq'	Nγ'	dc	dq	dγ	sc	sq	sγ	BC1	BC2	BC3		T/m²
1.5	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	22.2	10.4	32.6	13.0
2.0	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	29.5	10.4	40.0	16.0
2.5	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	36.9	10.4	47.3	18.9
3.0	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	44.3	10.4	54.7	21.9
3.5	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	51.7	10.4	62.1	24.8
4.0	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	59.1	10.4	69.5	27.8
4.5	2.0	2.0	1.709	0.0	31.8	17.4	8.2	7.6	1.0	1.0	1.0	1.3	1.2	0.8	0.0	66.5	10.4	77	30.8

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TEST CERTIFICATE

Report No.MM5251092022

CALCULATION OF SAFE BEARING CAPACITY BASED ON SETTLEMENT CRITERIA, BH-3

Depth in m	Average N Value	Width of Foundation, m	Settlement in mm by applying 1kg/sq.cm pressure	Corrected settlemnt in mm by applying w'	ABP in kg/sq.cm for allowed 50mm settlement	ABP without Depth Factor in T/sq.m	Depth Factor	Net ABP in T/sq.m
D	N	B	mm	mm	kg/cm^2	T/m^2	T/m^2	T/m^2
1.5	25.9	2.0	12.2	24.3	2.05	20.5	1.15	23.6
2.0		2.0	By Interpolation			21.2	1.20	25.4
2.5		2.0	By Interpolation			21.8	1.20	26.1
3.0	28.2	2.0	11.2	22.3	2.24	22.4	1.20	26.9
3.5		2.0	By Interpolation			23.9	1.20	28.7
4.0		2.0	By Interpolation			25.4	1.20	30.4
4.5	33.8	2.0	9.3	18.6	2.69	26.9	1.20	32.2

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TEST CERTIFICATE

Report No.MM5251092022

RECOMMENDED SAFE BEARING CAPACITY, BH-3

Depth	Width of Footing	Net SBC		
		Shear Criteria	Settlement Criteria	Recommended
m	m	T/m^2	T/m^2	T/m^2
1.50	2.00	13.0	23.6	13.0
2.00	2.00	16.0	25.4	16.0
2.50	2.00	18.9	26.1	18.9
3.00	2.00	21.9	26.9	21.9
3.50	2.00	24.8	28.7	24.8
4.00	2.00	27.8	30.4	27.8
4.50	2.00	30.8	32.2	30.8

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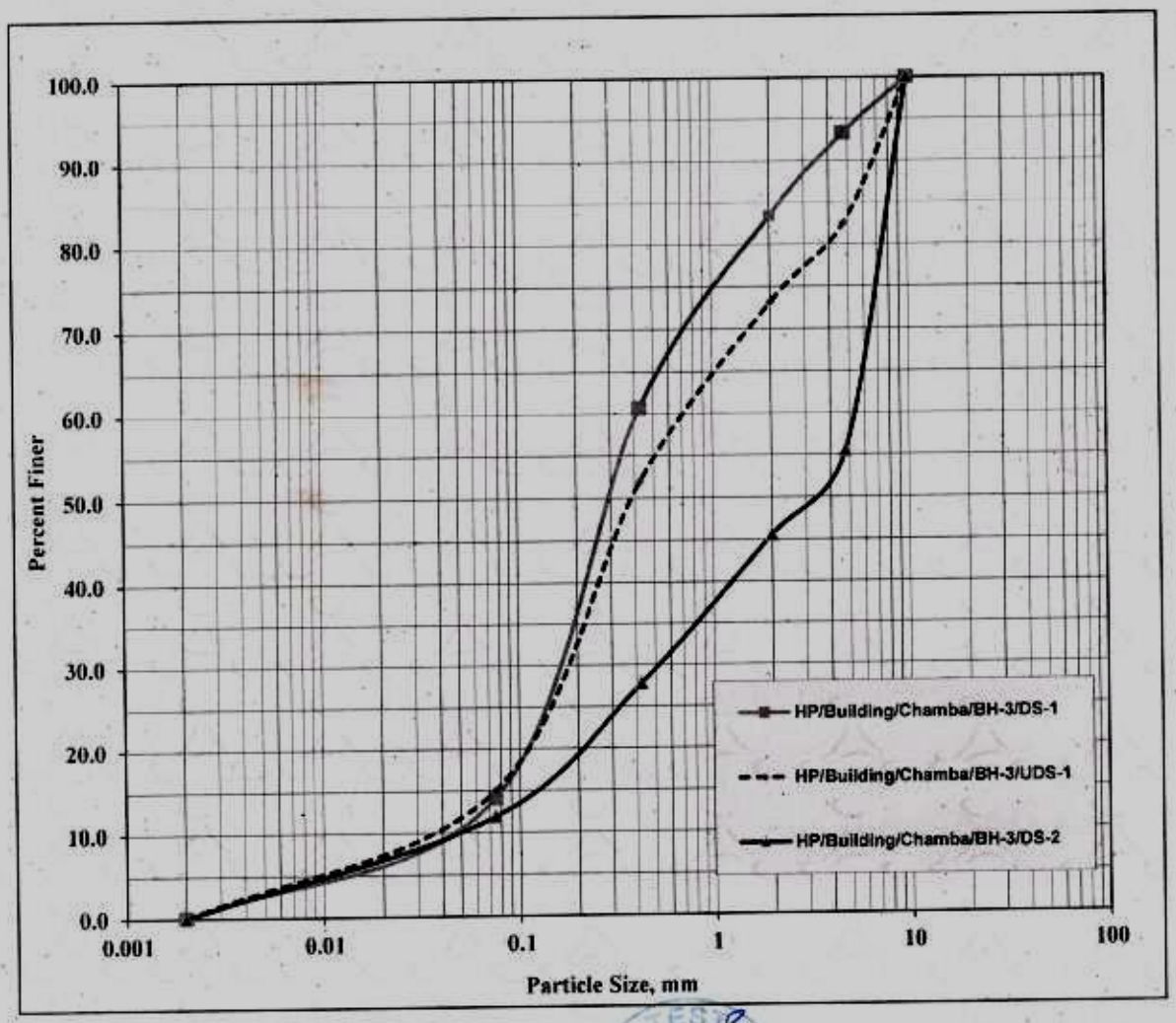
Report No.MM5251092022

GRAIN SIZE DISTRIBUTION CURVE, BH-3



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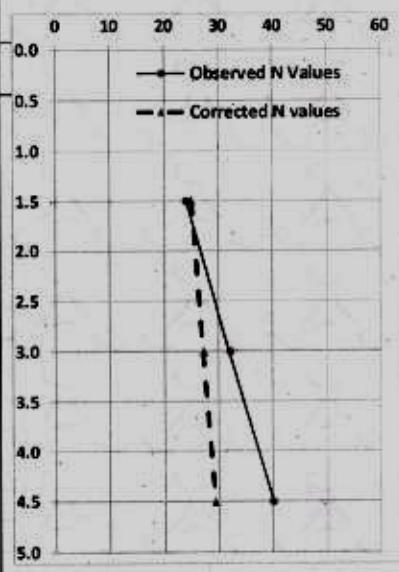
Report No.MM5251092022 PAGE NO.30

LOG OF BOREHOLE, BH-4

PROJECT								BOREHOLE NO.
GEOTECHNICAL INVESTIGATION FOR CONSTRUCTION OF BUILDING STRUCTURE, DISTT-CHAMBA IN HIMACHAL PRADESH								BH-4
LOCATION				DATE OF DRILLING		TERMINAL DEPTH		WATER TABLE (m)
4				08.09.2022		5.00 m		NIL

DEPTH M	OBSERVED N VALUE	CORRECTED N VALUE	SAMPLE TYPE	SAMPLE DEPTH IN M	DESCRIPTION OF STRATA	LOG	IS SOIL CLASSIFICATION
0.00					SILTY SAND WITH GRAVELS	0.00-2.00	SM
0.75			DS-1	0.75-1.00			
1.50	24	25.0	SPT-1	1.50-1.95			
2.25			UDS-1	2.25-2.55	BOULDERS WITH GRAVELS AND SAND	2.00-5.00	GM
3.00	32	27.1	SPT-2	3.00-3.45			
3.75			DS-2	3.75-4.05			
4.50	40	29.3	SPT-3	4.50-4.95			
5.00							

STANDARD PENETRATION RESISTANCE CURVE



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TEST CERTIFICATE

Report No.MM5251092022

LABORATORY TEST RESULTS, BH-4

BH-4		GRAIN SIZE ANALYSIS						ATTERBERG LIMITS			DENSITY & MOISTURE CONTENT					SHEAR PARAMETERS		
SAMPLE DEPTH IN M	SAMPLE NO.	CLAY	SILT	fine SAND	med SAND	coarse SAND	GRAVEL	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY	MOISTURE CONTENT	DRY DENSITY	SPECIFIC GRAVITY	VOID RATIO	TEST TYPE	COHESION, in kg/cm^2	ANGLE OF INTERNAL FRICTION, in Degree
		<0.002 mm	0.002-0.075	0.075-0.425	0.425-2.00	2.00-4.75	>4.75 mm											
		%	%	%	%	%	%	%	%	%	gm/cc	%	gm/cc	G	e		c	ϕ
0.75-1.00	DS-1	0.0	15.6	49.4	21.7	8.5	4.8	-	NP		-	-	-	-	-	-	-	-
2.25-2.55	UDS-1	0.0	17.4	40.1	20.3	6.8	15.4	-	NP		1.706	6.3	1.605	2.67	0.664	DIR	0.00	31.7
3.75-4.05	DS-2	0.0	12.4	16.6	16.3	11.3	43.4	-	NP		-	-	-	-	-	-	-	-

GRAIN SIZE PRESENTED HERE IS THAT OF PARTICLES PASSING 20mm, ALTHOUGH BIGGER SIZE PARTICLES IN SIGNIFICANCE QUANTITY PRESENT AT SITE.

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CALCULATION OF SAFE BEARING CAPACITY BASED ON SHEAR CRITERIA, BH-4

BH-4			Type of Foundation = Open, Isolated												Water Table Correction factor = 0.5				
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion 'c' t/m2	Angle of Shearing Resistance 'ϕ' degree	Bearing Capacity Factors			Depth Factors			Shape Factors			Bearing Capacity BC1=2/3c.Nc.dc.sc.ic	Bearing Capacity BC2=γ.D.(Nq-1).dq.sq.Iq	Bearing Capacity BC3=0.5.γ.B.Nγ.dγ.sγ.iγ.W'	Total Bearing Capacity BC=BC1+BC2+BC3	Net Safe Bearing Capacity S.B.C.(Net)=BC/FOS
D	L	B	γ	c	ϕ	Nc'	Nq'	Nγ'	dc	dq	dγ	sc	sq	sγ	BC1	BC2	BC3		T/m^2
1.5	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	21.9	10.3	32.2	12.9
2.0	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	29.2	10.3	39.5	15.8
2.5	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	36.5	10.3	46.8	18.7
3.0	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	43.8	10.3	54.1	21.6
3.5	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	51.1	10.3	61.4	24.6
4.0	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	58.4	10.3	68.7	27.5
4.5	2.0	2.0	1.706	0.0	31.7	17.3	8.1	7.5	1.0	1.0	1.0	1.3	1.2	0.8	0.0	65.8	10.3	76	30.4

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TEST CERTIFICATE

Report No.MM5251092022

CALCULATION OF SAFE BEARING CAPACITY BASED ON SETTLEMENT CRITERIA, BH-4

Depth in m	Average N Value	Width of Foundation, m	Settlement in mm by applying 1kg/sq.cm pressure	Corrected settlemnt in mm by applying w'	ABP in kg/sq.cm for allowed 50mm settlement	ABP without Depth Factor in T/sq.m	Depth Factor	Net ABP in T/sq.m
D	N	B	mm	mm	kg/cm^2	T/m^2	T/m^2	T/m^2
1.5	27.1	2.0	11.6	23.2	2.15	21.5	1.15	24.8
2.0		2.0	By Interpolation			22.1	1.20	26.5
2.5		2.0	By Interpolation			22.7	1.20	27.2
3.0	29.3	2.0	10.7	21.5	2.33	23.3	1.20	27.9
3.5		2.0	By Interpolation			23.5	1.20	28.3
4.0		2.0	By Interpolation			23.8	1.20	28.6
4.5	30.4	2.0	10.4	20.7	2.41	24.1	1.20	28.9

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TEST CERTIFICATE

Report No.MM5251092022

RECOMMENDED SAFE BEARING CAPACITY, BH-4

Depth	Width of Footing	Net SBC		
		Shear Criteria	Settlement Criteria	Recommended
m	m	T/m^2	T/m^2	T/m^2
1.50	2.00	12.9	24.8	12.9
2.00	2.00	15.8	26.5	15.8
2.50	2.00	18.7	27.2	18.7
3.00	2.00	21.6	27.9	21.6
3.50	2.00	24.6	28.3	24.6
4.00	2.00	27.5	28.6	27.5
4.50	2.00	30.4	28.9	28.9

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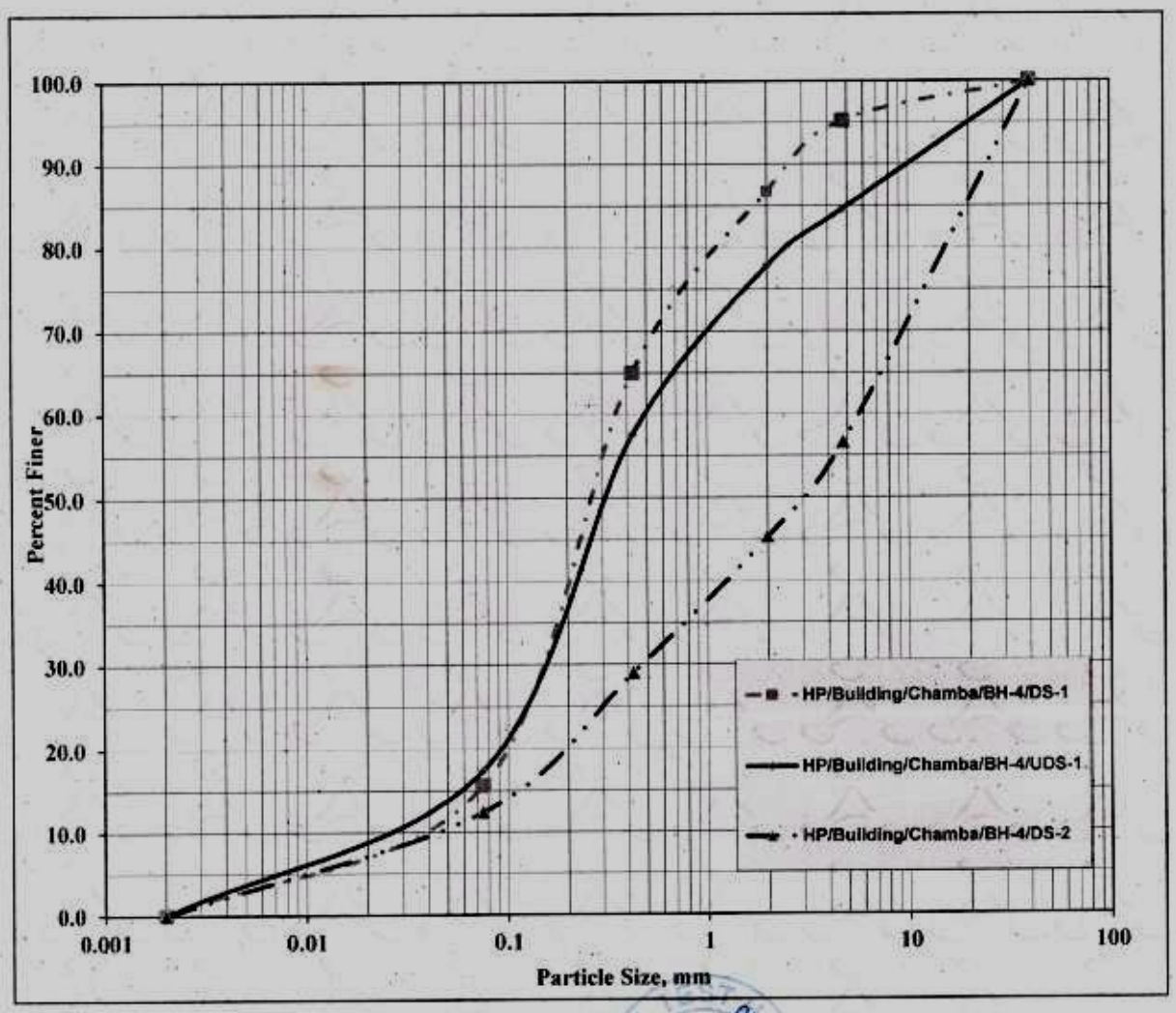
GRAIN SIZE DISTRIBUTION CURVE, BH-4



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Summary of SBC of Isolated Foundation,

Recommended SBC = 12.9 T/m^2 at 1.5m Depth

S.No.	DEPTH	SAFE BEARING CAPACITY (Ton/Sq.mtr.)				
		BH-1	BH-2	BH-3	BH-4	RECOMMENDED
1.	1.5 m	13.7	13.2	13.0	12.9	12.9
2.	2.0 m	16.8	16.2	16.0	15.8	15.8
3.	2.5 m	19.9	19.2	18.9	18.7	18.7
4.	3.0 m	22.9	22.2	21.9	21.6	21.6
5.	3.5 m	26.0	25.2	24.8	24.6	24.6
6.	4.0 m	29.1	28.2	27.8	27.5	27.5
7.	4.5 m	31.3	31.2	30.8	28.9	28.9

For Alpha Test House
Verified By

Authorized Signatory

End of Report

वाप्कोस लिमिटेड
WAPCOS LIMITED
(भारत सरकार का उपक्रम-जल शक्ति मंत्रालय)
(A Government of India Undertaking-Ministry of Jal Shakti)

Room No-C-24, Plot No-76 C, Institutional Area
Sector – 18, Gurugram-122015, Haryana

TENDER DOCUMENT FOR

CONSTRUCTION OF INDOOR STADIUM-AT CHAMBA, HIMACHAL PRADESH

WAP/CED/CHAMBA/2024/01

Date: 30/07/2024

Volume-II

FINANCIAL PROPOSAL

Volume-II

Section-X

FINANCIAL PROPOSAL

- **Letter of Transmittal for Financial Bid**
- **Total Cost of works**
- **BILL OF QUNATITY**

Letter of Transmittal for Financial Bid
(On Original Letter Head of Bidder)

Dated:

To,
Chief Executive Director
Environment & Construction Management
WAPCOS Limited,

Sub: Financial Bid for Construction of Indoor Sports Stadium at Chamba, Himachal Pradesh.

Dear Sir,

With reference to your tender document of subjected work, I/we, having examined the Bidding Documents and understood their contents, hereby submit my/our Bid for the aforesaid works. The Bid is unconditional and unqualified.

1. I / We acknowledge that the WAPCOS will be relying on the information provided in the BID and the documents accompanying the BID for selection of the Contractor for the aforesaid Work, and we certify that all information provided in the Bid are true and correct; nothing has been omitted which renders such information misleading; and all documents accompanying the BID are true copies of their respective originals.
2. The BID Price has been quoted by me / us after taking into consideration all the terms and conditions stated in the NIT, draft Agreement, our own estimates of costs and after a careful assessment of the site and all own the conditions that may affect the Work cost and implementation of the works.
3. I/ We acknowledge the right of the Authority to reject our BID without assigning any reason or otherwise and hereby waive, to the fullest extent permitted by applicable law, our right to challenge the same on any account whatsoever.
4. In the event of my/ our being declared as the Selected Bidder, I/we agree to enter into an Agreement in accordance with the draft that has been provided to me/us prior to the BID Due Date. We agree not to seek any changes in the aforesaid draft and agree to abide by the same.
5. I/We shall keep this offer valid as period specified in the NIT.
6. I/We hereby submit our financial BID and offer BID Price excluding GST as filled in excel format file of Summary Sheet of financial bid for undertaking the aforesaid Work in accordance with the Bidding Documents and the Agreement.

Yours faithfully,

Date:

(Signature, name and designation of the Authorized signatory)

TOTAL COST OF WORKS

Description	Total Amount (Excluding GST) (Rs.)
CONSTRUCTION OF INDOOR STADIUM AT CHAMBA, HIMACHAL PRADESH	**DONOT FILL COST HERE**
Total amount in words: **DONOT FILL COST HERE AS IT IS TECHNICAL PROPOSAL FILE**	

Note:-

- ***This financial proposal / Bill of quantity of tender is attached in Microsoft Excel format. Bidder shall fill the rates and corresponding amounts only in soft excel format. The bidder will upload same filled soft Microsoft Excel file during uploading of financial bid on online Portal.***
- ***The Bidder shall quote Rates up to zero decimal only in bill of quantity of tender.***
- The bidder shall quote keeping in view all associated costs with the project including any out of pocket / mobilization expenses/ Custom duty (if any) , Buildings and other construction workers welfare cess, TDS, taxes (except GST) if any applicable as per Govt. terms, shall be paid by the Contractor. The Goods and Services Tax (GST) shall be paid extra over quoted cost.
- It is mandatory to bidders to deposit GST within time limit framed by Govt. of India, if applicable. The Goods and Services Tax (GST), shall be reimbursed to the Agency only after uploading of bills by Contractor on GST Portal " to avail Input benefit of GST
- The payment will be made in percentage as per the schedule of stage wise payment
- The company shall be performing all its duties of deduction TDS and other deduction on payment made to the contractor as per applicable legislation in force on the date of submission of bid or to be newly / amended introduced during the execution of the Contract.

Important Note for submission of online tender:

- **Do not fill above table of Summary of Cost at the time of submission of technical bid.**

PAYMENT TERMS

The Stage wise Payments shall be made in **Percentage of the Total quoted Cost** of works as quoted by the bidder/ contractor. The "**STAGE OF CONSTRUCTION" for** each component shall be as per the details below.

Mainly Payment will be made after completion of particular "**STAGE OF CONSTRUCTION"** as per the detail in the **Scope of Work** in compliance of all the conditions mentioned in the Tender Document.

The main scope of work for each component shall be governed as detailed in the "**SECTION of SCOPE OF WORK" of** the tender document and final payment shall be made accordingly, to the Contractor.

If any works mentioned in the payment terms / Section of Scope of work, are not executed, then payment will be deducted as per the provision in DSR-2021 for scheduled items and Market Rate analysis by Engineer in Charge for Non Schedule items.

Stages of Payment			
S.no.	**Payment Stage**	**%age payment**	**Cumulative Percentage**
1	Site Leveling and Site Preparation, Installation of Site Office, CCTV Camera & GFC Drawing vetted as per tender Condition	1.1	1.1
2	Construction of Boundary Wall	1.4	2.5
3	Excavation and Completion of Foundation	2	4.5
4	Completion of Civil work Ground Floor	7.5	12
5	Completion of Plumbing work of Ground Floor	1.25	13.25
6	Completion of Electrical work of Ground Floor including Telephone conduits etc.	2.25	15.5
7	Completion of Finishing work including flooring, Joinery and painting of Ground Floor	3	18.5
8	Construction of Ramps, Entrance Lobby and Entrance Stairs	2	20.5
9	Completion of Civil work First Floor	7.5	28
10	Completion of Plumbing work of First floor	1.25	29.25
11	Completion of Electrical work of First Floor including telephone conduits and lighting conductor etc.	2.25	31.5
12	Completion of Finishing work including flooring, Joinery, Overhead Tank and painting of First Floor	3	34.5
13	Completion of Providing and installation of Automatic Fire Alarm and firefighting Works	2	36.5
14	Installation of Lift (8 Passenger)	3	39.5
15	Completion of Civil and prefabricated structure/Civil Work work of Indoor Hall	8.5	48
16	Completion of roof work including installation of truss/roof sheet work of Indoor Hall complete in all respect	7.5	55.5

17	Completion of flooring work of Indoor Hall complete in all respect	5.4	60.9
18	Completion of Fire Fighting work of Indoor Hall	2	62.9
19	Completion of Plumbing work of Indoor Hall including water tank	1	63.9
20	Completion of Electrical work of Indoor Hall including Telephone conduits etc.	3.5	67.4
21	Completion of Finishing work including flooring, Joinery and painting of Indoor Hall	3	70.4
22	On Completion of exterior plaster/ cladding / paint work	2	72.4
23	On Completion of interior installations including signage's, window blinds, false ceiling, SS railing etc.	3	75.4
24	On Completion of Site development work including footpath, external sewerage, distribution line, service trenches, Storm water drains distribution line, peripheral grids etc.	4.5	79.9
25	On Completion of E & M Works including Electrical Substation, CCTV, Solar System & Street Lights etc.	4	83.9
26	On Completion of Specialsed Badminton court Mat/ Flooring for Indoor Hall	6.5	90.4
27	On Completion of Other Sports Facility including but not limited to Specialized Seating, Score Board, Referee Chair, Badminton Net, Movable net post etc.	4.6	95
28	On Completion of building and external development in all respects as per tender document and to the complete satisfaction of Engineer In charge/ Client Department.	5	100